COAL AGE

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IF some of the miners who quit digging "before the war" were to go through our present day mines, they would be surprised to see how differently they are now operated. We have new appliances everywhere demanding more skill and involving more danger. Every part of the work is conducted at greater speed.

"Your mines are better" they would say, "and you must have cleverer men to operate them." The reply would be, "No; we never had such incompetent miners. Before the war we had skilled workmen from England and Scotland and some from Ireland, and the last mentioned, though not brought up to mine coal, made up by wit what they lacked in experience. Besides, they understood English.

"Now we have men fresh from the European farms, who can't understand what they are told and have absolutely no knowledge of mining. Today we should have more brains underground, but we really have less. We are more anxious to have safety, yet the men we control are devoid of the first rudiments of mining knowledge."

Those who will, may say that the education of the miner is not a need of the present day colliery. There is not a job around the mines but what would be better done, more quickly performed and handled with less waste were the man who did it trained to his work and taught to make his right hand and his brain act in unison.

You are exasperated when your timberman can't read a blue print and your blacksmith can't shoe a mule in the approved style, and your workmen are vexed when you put up a new plant and bring half the skilled workmen from the nearby towns instead of using those from the colliery villages.

Give your men some chance to develop at the evening school; put a spirit of craft pride in their hearts; make good work a matter for discussion in leisure moments, and the city mechanics will stay in their home towns.

The cost of coal and the intelligence of the workmen, rise and fall with the self-same tide. The man without training needs continual oversight and the wages of the superintendent who is obliged to watch him must be paid.

If in a bit of blue paper he has all the boss he needs and if the joy of his work will make him swing his adze without the ever-present eye, he is a valuable employee, cheaper to a company than any much-directed, much-goaded workman can ever be. The cheapest man is the mechanic with character and training who thinks for himself and takes pride in the quality and quantity of his output.

And if your higher education does not serve to make good workmen, this cannot be said of training in the craft. Education has armed not a few rogues, but it never made a poor workman, if his training and the work he had to perform were along similar lines.

Even the forger takes pride and works diligently at the trade he has learned, and your defaulting highly educated cashier was always known as a neat penman. Training, good workmanship, large output and contentment go hand in hand.

It may not give character also, but it will at least not destroy what is there and the evening occupation of the night school will remove the temptation of the saloon and gaming table and that unsatisfied idleness, which sows the seeds of unrest and discontent.

He who has taken time and pains to qualify will take a measure of both to show that he really possesses the ability of a good workman. Such a man has no satisfaction if his task is not well done. That nightly labor was undertaken in a serious spirit, and you can wager the day labor will visibly reflect it.

No sorrow depresses the spirit of a man like labor enforced, none so elevates like labor desired. It is the trained man who casts down his work with a sigh of regret and takes it up with a smile of relief.

The above foreword was written for COAL AGE by a reader in the anthracite (Penn.) field.—Editor

Ideas and Suggestions

Interesting Talks Submitted in Response to Our Recent Request for Forewords.

Off the Track

By Joseph Cain*

Whenever I visit a neighboring mine, there is always a lull in the output of coal. The foreman gets nervous and voluble and turns to me apologetically. "It's always this way when a stranger comes around. They're off the track again. I always know it'll be that way when anyone comes to look the mine over." But there isn't any coincidence involved. Cars leave the track all days in the week except Sunday. It doesn't take a Sherlock Holmes to ferret that out, for a long line of cars on the dump with their wheels in the air, with axles bent, sides broken, bumpers off and bars twisted is sufficient evidence that track trouble is a chronic condition at that mine.

And these are results of certain conditions which ought not to exist. Every broken car is the visible sign of a broken track rule; neither strangers, nor malice prepense on the part of the inert car body can be blamed. No car ever "happened off the track." The fact that they ramble into the rib, twice, thrice and more times in the same place or that some cars are more prone to take to the ditch than others is proof that blind luck does not direct their wanderings.

Those wrecks are due to defective car wheels or to the accumulation of dirt between the straight rail and the switch, or perhaps the blacksmith is to blame because he did not make a perfect weld in the frog and the roadman was censurable because he spiked the frog to hold it together when he might have known that he was only making a temporary repair.

He might know that the blacksmith could as well repair the frog as straighten out the irons of a wrecked car. That slackness which saves the blacksmith for a day or two is apt to give him more work than he can repair in a week and it is lucky sometimes if he does not have to summon trackman, carpenter, foundryman and perhaps doctor and undertaker to correct the evils which that bad weld entailed.

Ties left till rotten, old room switches left till that tomorrow which never comes, are other causes. The tomorrow of the roadman drags lead-foot from day to day, but the derailment and resultant pile-up do not lag and they cause damage ten times as costly as the repair of the defective part would be.

Unfortunately road repair is "dead-work" on the payroll, in the mind of the superintendent, of the foreman and even of the roadman. Let it go, perhaps the car will stay on! Why worry?; the tracks are worse elsewhere. But when the next car strays into the ditch remember that "there's a reason" and do not blame your luck. When your tonnage falls do not charge it on unforeseen difficulties. Your cars only take the erratic courses which your own negligence provides.

And further do not envy the man whose tonnage comes out as if regulated by clockwork, without heat, recrimination, excitement or clever improvisations. Some men are clever at meeting emergencies, there are others who are skilled in avoiding them. Which are we?

*Superintendent, Fentress Coal & Coke Co., Wilder, Tenn.

The Heroism of the Miner

By Sim Reynolds*

It surely has not passed unnoticed by those who have interested themselves in mining at least during the past ten years, that there exists among the workers of the underground world a courage or a fearlessness—or whatever you care to term it—in the face of danger, which certainly is not of the common brand; seems rather to be a trait which comes natural to the collier, and characteristic of the man.

I am not speaking now of that variety of courage which is at times exhibited, that contempt for danger, past, or present, such as was exhibited by the Staffordshire collier a good many years ago, who, when brought with others to the surface after being entombed for 10 days or more, surprised the sympathizing spectators by inquiring, "Which dog won?" A dog race was to have been pulled off the day they were entombed, and Jack's whole interest in life centered in the particular dog he had backed to win.

The fearlessness which impresses us is that courage which takes the average miner back into the mine after a disaster, after an explosion, or during a fire, or a flood, when at times his chances of returning alive are perhaps one out of three, if placed on a gambling basis.

It would seem that there is something in the very nature of the miner's life, perhaps his close association with the ever-present dangers of his everyday work that breeds a fearlessness which serves him well in a crisis. One thing is certain; his deeds of valor require no martial music, no military display.

Grandstand heroism plays no part in the ordinary miner's courageousness. When recently the waters from a cloudburst drowned a score of miners like rats in a hole, the editor of a country paper commented upon the indifference which the outside public showed, immediately after the accident, to the distress and suffering caused by the death of the wage-earners.

It occurred to me that had it been possible for that same public to have witnessed with me the heroism and self-sacrificing spirit shown by these underground toilers in their hour of peril, it could not but have felt proud of the courage exhibited and anxious to do all in its power to relieve the unfortunates left behind.

Some of these miners, though at the surface when the cry of alarm was raised, without a moment's hesitation rushed into the mine, from the free air of the surface, from the light which lends courage, to the depths and darkness of the mine, ignoring their own safety in an effort to save life, descending hundreds of feet below the surface of the earth with hardly a good fighting chance of coming back safely. The miners plunged without a moment's hesitation into a torrent of rushing water which was carrying horses off their feet and drowning them. Such unselfish heroism would surely have filled their hearts with charity and admiration for these unpretentious heroes.

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And, strange as it may seem, these men who "won out"; those who did escape, who yesterday stepped to the very brink of the valley of death, close enough to the "Grim Reaper" to feel the edge of his scythe, were back again the next day working in their accustomed places as if nothing had happened.

Coal-mine owners generally in this country today, are doing as much for the welfare and safety of the men in their employ as can be reasonably expected, and as a whole are perhaps spending more thought, more time, and more money, toward improving the safety and general conditions of the miners and their families than any other body of employers in the world; but the duty of the whole community, and the public generally, should not end with that comfortable reflection. It would be to the credit of the public as a whole and—especially that part of it living largely on the purchases of the miner in towns where the prosperity of all naturally depends upon the mining industry, to show a true spirit of charity and open-hearted interest in the welfare of the miners and their families, and not a casual morbid curiosity, immediately after an accident.

Employers vs. Employees

By James Prendergast*

The feeling of unrest which prevails among the laboring classes today has been particularly in evidence in the mining industry for a long period of years, having manifested itself in the guise of petty strikes which have resulted to the detriment of all concerned.

Coal operators generally, appear to believe that a certain amount of trouble with the men must be expected, and that occasional strikes are to be considered as a part of the cost of production.

What is the reason for this friction? My observations lead me to believe that the mine officials, generally, regard the demands of their employees as a transgression on their rightful prerogatives, and that they alone have the right to say what should, or should not be done.

The men, on the other hand, regard the mine official as a sort of a dragon who is trying to deprive them of their sacred rights. Either party is loath to believe in the other. With such a spirit prevailing, it is no wonder that the two parties are generally at sword's points.

I know a case of a superintendent who had lived at, or near, the mines most of his life. He received a good education, winding up with four years at college in mining engineering. Soon after graduating, he was placed in charge of the development of a new mine, of which he was afterward made superintendent. He had a good basic knowledge in regard to the mechanical side of coal mining, but no training in handling men, which his new position demanded. He consequently had numerous petty strikes and dissensions at his mine.

When he prepared his first year's cost sheets, however, he was brought to a full realization of the enormous expense of these labor troubles, and this started a new train of thought. He developed a new viewpoint and tried to look at both sides of his controversies with the men. His consequent treatment of their demands differed widely from his former practice, and much to his surprise—and probably that of his men as well—the friction practically disappeared. The demands became fewer and more reasonable, and the replies accepted in a better spirit.

He then realized that the big majority of the employees were fair and reciprocated to fair treatment. This was a strange contrast to his former ideas and those of his associates. The cost sheets reflected the improvement, and he has not had a strike for over two years.

This concrete example shows one man's awakening to something his fellow operators must all be subconsciously aware of but fail to correct.

Are we not on the verge of a new era in the mining industry, where employer and employee are to regard each other in a different light? Will this not add to the benefit of all parties concerned, both in a financial way and toward promoting a more general contentment all around?

*Superintendent, Mine No. 3, Pittsburgh-Belmont Coal Co.

The Personal Element in Safety

By J. M. Hefron*

The tendency of the times is to safeguard the worker in all fields of labor. So in mining, one of the most hazardous of occupations, the adoption of every rule and appliance which can aid in preventing accidents is constantly urged by operators and mine workers' organizations.

Falling coal and slate, with the handling of powder being the most prolific sources of accidents, it would seem that with vigilant care, their number might be reduced to nil. But legislatures may enact laws and appoint inspectors to see that they are enforced; operators, and the intelligent and careful workers may follow every suggestion made for rendering the mines safe and for protecting the employees; the government may have its rescue cars and experimental stations, and may issue pamphlets of instruction, all in vain, if the wilfully careless and illiterate continue unrestricted in their negligence or ignorance.

Coöperation is essential to the success of every undertaking, and more necessary where safety of human life is the aim. Of little avail are mere rules and regulations, if a miner, whose working place is unsafe persists in refusing to timber it when repeatedly ordered to do so and when all necessary timbers are supplied. To further destroy what little force a regulation may have in protecting life, the menace of a strike is held over an operator should a workman be discharged for a failure to comply with the rules established for his safety.

Equally useless are the orders to those like the recently immigrated Russian who charged and tamped his shot, lighted the fuse and stood nearby to see it go off. Only the rescue car is of service here. With such careless negligence and gross ignorance to contend with, will it ever be possible to eliminate to any great extent the dangers of mining?

As in all employments, familiarity, even with danger, breeds contempt, and persons who every day risk their own lives, or the lives of others, grow to think nothing of the dangers which menace them. Not that they hold lightly the value of a human life, but, daily companionship with danger effaces the natural fear and caution with which we ordinarily approach any risk, so that the mine worker takes chances which to the observer will appear criminal.

A miner may think that after a fall of slate, the roof will stick until he gets timbers under it, and that error in judgment may cost him his life. There should be no guessing, but a certainty of safety

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in every action; no surreptitious opening of powder cans with picks, or drilling of an unexploded shot to ascertain why it did not explode, actions which not only the law but common sense prohibit.

There no doubt have been, and will be, numberless suggestions of remedies for this evil, but, one thing is certain, unless there is the heartiest coöperation of the mine worker with the operator and legislator, no far-reaching good can result. The educating work must be directed at the two chief factors in the difficulty—the wilfully, or negligently careless worker and the ignorant novice in the art of mining. Make them see the need of caution in everything, no matter how small, and then there will not be a holocaust of life in the furnaces and fireplaces of our country.

A Coal Mountain in the West

By Aubrey Fullerton

A new coal find in the far West gives promise of the easiest mining on the continent. It is an immense deposit of good anthracite coal, in the foothills of the Rockies, 50 miles southwest of the city of Calgary, Alberta. There a mountain range runs to its height in Mist Mount, 10,300 ft. above the sea, and for 15 miles it shows an unbroken formation, in which is a continuous and regular ridge of coal. This mountain of coal runs from 200 to 1500 ft. above the surrounding levels. The seams cover an area 1½ miles wide, and they go, it is estimated, 3000 ft. below the surface. There are said to be millions of tons ready for mining.

The coal deposits in the western part of the continent, running in broken stretches along the line of the north-and-south mountain ranges, are of various grades, from lignite to anthracite. The latter, belonging to the Kootenai series, are of only infrequent occurrence, only three or four seams, in fact, out of the many. Moreover, some of these are inaccessible. The finding of a literal mountain of high-grade anthracite coal, within easy reach of a market that badly wants it, was therefore miners' good luck.

The unusual thing about this coal find is that so large a part of it is on top. When the Rockies were piled up by convulsions from within, ages ago, this mass of coal was lifted to from 200 to 1500 ft. and tilted almost perpendicularly. The seams show today in dips of from 46 to 82 deg. from the horizontal, with thin roofs of shale, slate, and sandstone. At various points age-old streams have worn into the mountain side and made exposures where the coal shows plainly in the steep slopes and in the beds of the streams.

Tests of the coal have shown it to be of a grade corresponding almost exactly to Pocahontas coal. A smaller deposit in Montana displays very similar conditions, but engineers who have examined the Alberta find declare it to be the largest known surface exposure of anthracite coal in the world.

So easily accessible is the coal that it can be mined for less than 70c. per ton, on engineers' estimates, and can be landed in Calgary, its nearest market, for $2.27 per ton. For the same reason the surface mine will be practically strike-proof, inasmuch as the least experienced labor will be equal to picking up coal on the level and loading it into cars. At any point hundreds of tons can be brought down by blasting.

It is likely that this unique bed of semi-anthracite, which was discovered only last year, will be developed, in part at least, as a municipal enterprise. The city of Calgary is negotiating for its purchase as a source of supply for its future heating and power necessities. An easy-grade railroad, built right to the foot of the mountain, will put the city in close touch with a fuel supply large enough to last it, presumably, for all time. And the surplus can be distributed over the fuel-hungry prairie country to the east at from $3.50 to $4 per ton.

Exposure of a Bed of Coal Caused Through Erosion by a Stream

A 17-ft. Seam of Coal Tilted Almost Perpendicularly

Ohio River Improvement

Special Correspondence

The Monongahela and Ohio River coal operators, and even those operating mines inland in western Pennsylvania, eastern Ohio and West Virginia are vitally interested in the progress of the task of making the Ohio River navigable the year round. An even dozen of the 48 dams planned by the Federal Government have been completed and work has been started on 16 others.

During the coming autumn probably three more dams will be completed on the first 100-mile stretch of the Ohio River going south and west from Pittsburg.

Dams Nos. 1 to 6 extending from Pittsburg to Merrill have been finished and No. 7 at Midland, Penn., has been started, No. 8 at Walker, between East Liverpool and Wellsville, Ohio, is in operation, while No. 9 at New Cumberland, W. Va., will see its lock walls completed this summer. Dam No. 10, near Steubenville, Ohio, will be started possibly this year, while No. 11 at Wellsburg, W. Va., is now in operation. No. 12 at Sisters' Island, is under course of construction, and will be finished before many months. No. 13 at McMechan, W. Va., is ready for business, and as a result considerable coal is being loaded on the river by the coal operators just above this dam. Plans have been completed for starting dams Nos. 15 and 16 above and below Moundsville, W. Va.

The completion of this string of new dams will permit the shipment of more than double the amount of coal south from the Pittsburg and West Virginia fields, taking present records for a base.

Electric Motors for Mines

Special Correspondence

A comprehensive review of the current practice in the use of electricity in British mines. The general adoption of this power for underground service has been seriously retarded because of the danger in gaseous mines. The English engineers have overcome this difficulty on motors of moderate size, while on those of larger capacity the problem is solved by providing special ventilation at that point.

Although European practice in the construction of electrical apparatus for collieries has always been marked by a careful regard for safety and efficiency, there has been a growing feeling that the designs, which answer perfectly well for surface work, are not always adaptable to underground conditions, exposed to water, coal dust and gas. And further, the attendance on underground motors is not usually of a technical nature, and the motor may be subjected to considerable ill treatment and possibly overloading, rendered possible by the obscure position in which it is frequently placed.

The recently issued mining regulations for Great Britain, are indicative of the care which has to be taken in installing electrical machinery underground, and these have materially assisted a movement toward an improvement in design.

Requirements of a Mine Motor

The principal direction in which modification of design has taken place is toward meeting the requirements for thorough enclosure. It has been realized that there is hardly anything so penetrating as gas, and for situations where firedamp is likely to occur total enclosure appears to be the only safeguard. Open type motors are not particularly safe apparatus for use in a pit even when squirrel-cage induction motors are used; there is always the danger of the gap between stator and rotor becoming reduced by the wearing of the bearings and (in larger sizes where the carcase is on separate bedplate to the bearings) the relative displacement of the rotor and stator. This may bring about touching and sparking leading directly to trouble if the mine be fiery. There is also the danger of dust accumulating on insulating surfaces and in air gaps. A protected type of motor affords mechanical protection, but does not obviate these dangers.

Some motors have been fitted with a very fine mesh covering analogous to the screen of a safety lamp, with the idea that any ignition of gas in the interior of the casing would not be communicated to the outside. This might probably be the case if such a flame burnt steadily and quietly, but in view of the possibility of a small explosion inside the casing, it is open to extreme doubt whether the flame would not pass through the mesh. It would, therefore, appear advisable always to make a motor entirely closed and airtight when it is to be placed underground in a fiery mine.

This total enclosure involves two main points in design. The first is that hermetical sealing converts the motor into a species of bomb and either the mechanical strength of the carcase must be sufficient to resist the explosive strains or some means must be provided for dissipating the pressure by allowing the gases to escape at such a temperature that they will not ignite the exterior gas.

The second consideration is that total enclosure prevents free access of cooled air, and, therefore, the temperature rise of the coils for a given horsepower output per pound weight of machine, is greater. It has been the aim of manufacturers to reduce the weight and cost of totally enclosed machines by artificial ventilation.

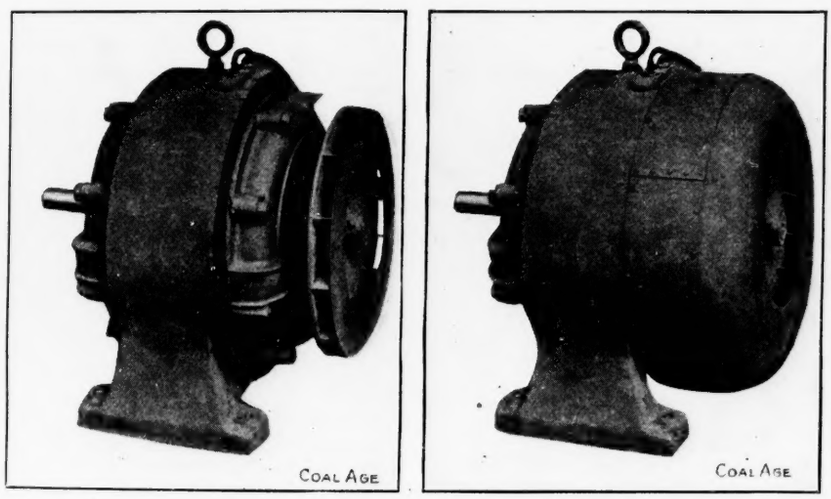


FIG. 1. MAVOR & COULSON ALTERNATING-CURRENT MOTOR, SHOWING VENTILATING APPARATUS

The Phoenix Motor

The Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, Yorkshire, has made an interesting contribution to motor design, after coöperation with several well known English mining engineers. Total immunity from the passage of flame under explosion pressure is achieved by making all joints of great width. There are no oil chambers or passages, and the bearings, which are placed outside the motor proper, have no direct communication with the interior of the machine.

Where the shaft passes through the castings, cooling glands are fitted, the efficiency of which has been fully established by tests; it has two large doors of adequate size for adjustment. These doors are sealed in a simple manner so that the motor cannot be opened by any unauthorized person.

The machine is fitted with observation windows consisting of ½-in. plate glass, suitably protected. The leads are all brought out at the top and arranged in such a position as to prevent damage by abrasion. It is designed to give its full output at a specified temperature rise. Further it will give 25 per cent. overload without sparking and 50 per cent. overload without serious sparking; the clearance between the brush holders and the carcase is unusually large.

The motor is fitted with heavy type ball, or roller bearings and the housings are dust tight. There are no oil wells and the machine can be run for three months without a renewal of the grease being necessary. The bearings are of a special type, manufactured to withstand shock, oil creeping and leaking, overfilling of oil chambers, and any chance of hot bearings.

As the insulation of a mining motor must be moisture proof and of exceptional quality and durability, the Phœnix motor is insulated by a special process, each coil being subjected to a high pressure test after winding, and after fitting into the core, and on the completion of the armature. The windings are impregnated under vacuum on two separate occasions, and at the last operation they

are subjected to a pressure of 50 lb. per sq.in., thus assuring that the interstices are well filled with insulating material. No insulating material or varnish is put into the machine unless it is capable of standing without damage, a temperature of 250 deg. F.

Testing Motors for Mine Use

A series of tests were taken on this motor to determine its explosion resisting qualities. The motor was placed inside a chamber and connections made for passing a mixture of gas and air previously tested by an explosion meter, into the case; the most explosive mixture procurable was used. Sparking plugs were fitted, one inside the motor itself and the other inside the case.

The motor was first filled with the gas and air mixture, and exploded electrically by means of a sparking plug. After five or six similar tests no detrimental effect or any signs of explosion were visible, thus proving that it was quite suitable for withstanding explosion pressures.

The gases were then blown out of the motor, which was again filled with gas and air, and the complete machine was placed inside the wooden explosion chamber, which in turn was filled with the correct mixture of gas and air. The mixture inside the motor was then fired and the gas in the explosion chamber itself was not exploded. Then, as a proof that this outside mixture was actually explosive, the sparking plug fitted therein was fired, and a complete explosion followed.

The whole object of this test was to reproduce as closely as possible the actual conditions which would obtain in a fiery mine. It is obvious that the first time the doors were opened below ground the motor itself would become full of the gaseous atmosphere surrounding it, so that in the case of a short-circuit or spark occurring in the machine, this internal mixture would be exploded. It was established by this test that in the event of such an explosion occurring it would be confined to the interior of the motor.

Design of the Carcase

In some cases the mechanical strength of the carcase has been increased by using steel instead of iron. Attention is now being devoted to the provision of pressure-relieving devices in motors on the principle of allowing the exploded gas to escape rapidly, cooling them in transit.

A. Thomaelen, writing in *Gluckauf*, described a motor whose carcase is fitted with a series of protecting plates, consisting of a number of metal sheets spaced about one hundredth of an inch apart, these sheets being ring-shaped and held by suitable end pieces so as to form short, hollow cylinders. These cylinders are included in the motor carcase so as to afford the only air vent for the whole of the motor (in the totally inclosed type) or for the commutator chamber, where the windings themselves are left open to the air.

Should an explosion occur in the inclosed space, the burnt gases expand through the fine apertures, thus relieving the motor carcase of strain, and in their transit are cooled by the large surface of metal to which they are exposed. In experiments made at the Geselkirchen testing station, motors so constructed were found to be satisfactory so long as all the air spaces were sufficiently fine and there were no concealed defects in the carcase.

Reference has just been made to inclosing only the slip rings or commutator, i.e., the portions where sparking might be likely to occur in ordinary running. This is satisfactory so far as it goes, but in fiery positions total inclosure is preferable.

Ventilating the Motor

The ventilation of such totally inclosed motors is a matter for consideration in order to secure economy with safety, and some very interesting designs have been produced in this connection. One good machine of this kind has two end plate type bearings, each being fitted to take a ventilating pipe, which can be led to any source of cool-air supply. This enables practically the same output to be obtained as with the semi-inclosed type motor, while retaining the advantages of the totally-inclosed type. The air is drawn through the machine by means of a box-type fan, fastened on lugs cast on the pulley end of the armature or rotor spider.

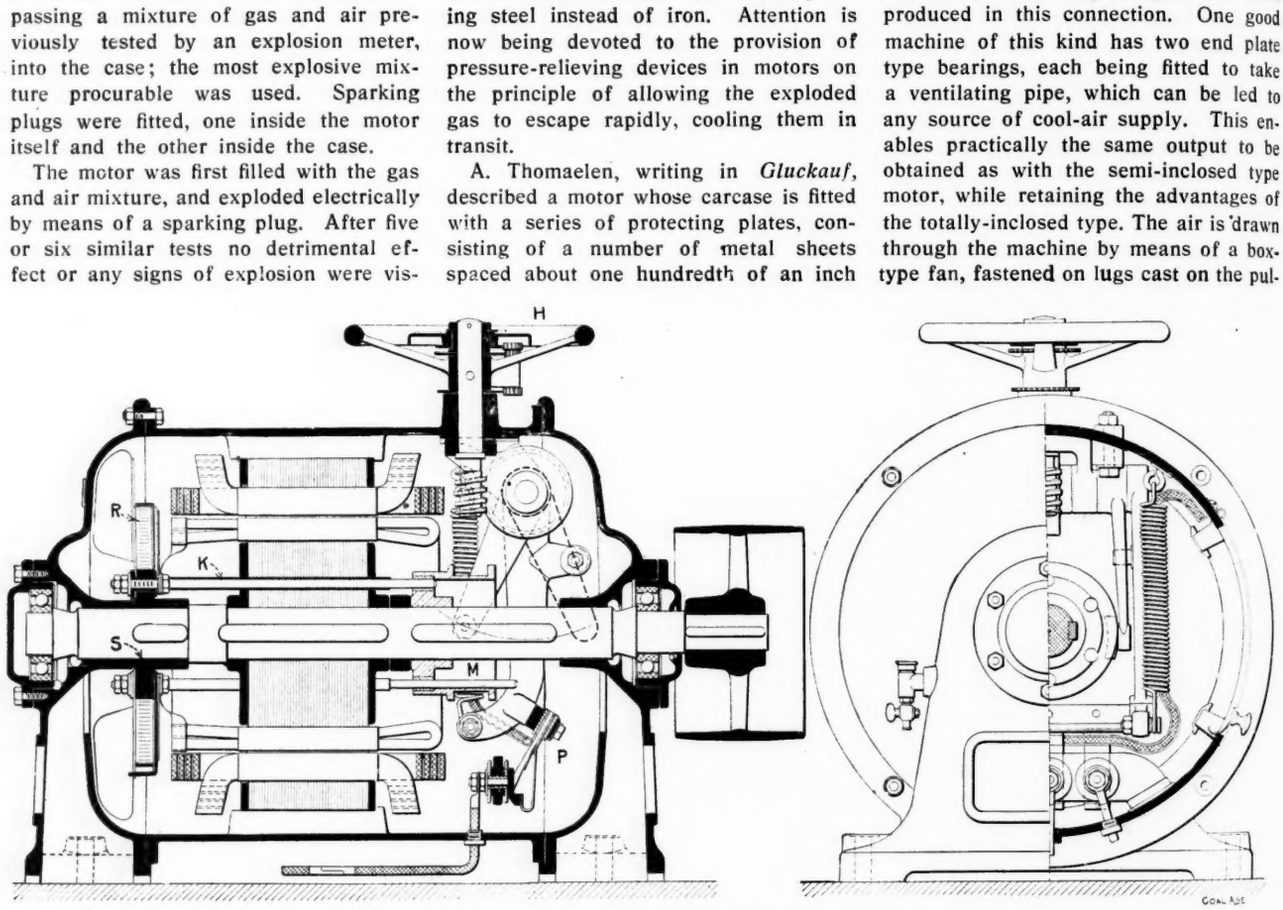


Fig. 2. Three-phase Motor with Forced Ventilation

A somewhat similar machine has its ends closed in by plates, having at the top of their vertical diameters a short chimney, whose upper end is protected from dripping water by an inverted saucer-shaped casting; these two chimneys are connected by ducts, in the interior of the motor, through which air is propelled by a fan from one chimney to the other. This type has been found to be eminently suitable for haulage gears, pumps and similar plants, particularly where exposed to dripping water.

Mavor & Coulson, Ltd., of Glasgow, have lately designed a tube-cooled inclosed motor, which, while securing complete inclosure, avoids any undue increase of size, as compared with an open-type motor of the same output. In this motor there are groups of tubes inside the motor

carcase, opening at both ends to the external atmosphere, which are cooled by an air circulation provided by a fan, or the motor outside the carcase.

Where necessary, end plates with strongly bolted face joints are fixed so that an internal explosion cannot be communicated to the outside air. The internal air of the motor is kept in steady circulation by the fans, meeting the groups of tubes and communicating its heat to them, these tubes being in turn kept cool by the outside air. There is no change of air from inside to outside the shell, but of heat only. In Fig. 1, on the left, is shown an alternating-current motor of this type with the end casing removed and showing the series of holes corresponding to the tubes, and the fan impeller, in which it will be seen that the fan and tubes are external to the chamber containing the windings; on the right is shown the same motor with the outer covering put on.

Three-phase Motors

Some new three-phase motors, with forced ventilation, are worth noticing in this connection, because the starting resistance is combined with the motor inside the carcase, being placed on the same shaft as the rotor, with which it rotates. The starting resistance control also operates the main switch, to which it is keyed. A ventilating equipment which is placed inside the motor casting produces a strong current of air, which is drawn into the motor through the foot of one of the end plates, passing along the whole length until it is finally expelled through the base of the other end plate. In this way a very efficient ventilation of the motor is obtained, in spite of the inclosure and its reduced size.

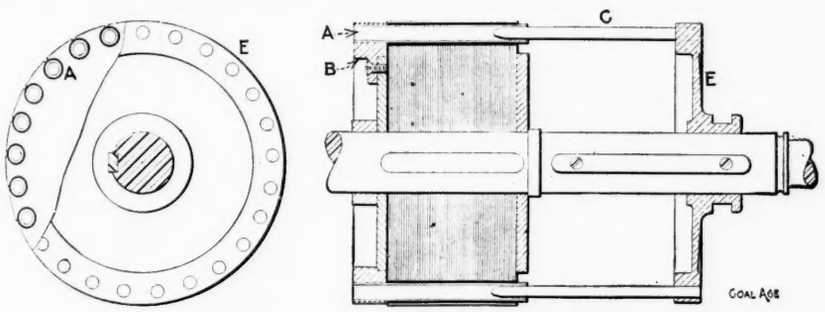


Fig. 3. Armature for Three-phase Motor

The fact that the motor is almost entirely inclosed enables it to be installed in places where protection is necessary owing to the dropping and splashing of water. Where there is much dust the motor can be completely inclosed. In such cases direct communication with the outer air must be established in order that there may be proper ventilation. When especially modified, these motors may be used in fiery mines.

The general arrangement of this type motor is shown in Fig. 2. The carcase is built of cast iron, and at each end are fixed the covers which form the motor feet, the carcase being turned if required through 90 or 180 deg., so that the starting wheel can be arranged either at the top side or underneath the motor.

The starting gear consists of a resistance *R* of copper ribbon rolled in the form of a thin coil. This resistance is fixed to the motor shaft directly behind the armature (the construction of which is shown separately in Fig. 3) on a support *S*, which also carries the contacts. The contacts are made of polished copper strips of unequal length, which are placed around the shaft, and which are successively shortcircuited by the sleeve *M*. The number of contacts is six for motors of capacities not exceeding 25 hp., while the larger sizes have nine. By using this type of starting equipment, collecting rings and brushes are not needed, thus avoiding the only parts which require constant supervision.

The main switch is also located inside the motor, while, if desired, an ammeter (Fig. 4) can be placed on the casing. By thus connecting all the controlling apparatus within the motor, the use of a switch board is avoided, as only the fuses need be separate. Switching in, starting and short-circuiting the winding are all affected by the hand wheel *H*, which is placed on the motor body. By turning this wheel the switch is operated, strong springs insuring a good contact. Further turning of the wheel in the same direction operates the sleeve *M*, thus gradually short-circuiting the starting resistance. To switch out the motor the wheel is turned in the opposite direction. The motor can, therefore, be easily looked after, and no mistake in the switching can possibly be made.

In order to obtain good ventilation inside the motor, a fan is placed directly behind the rotor on the starting resistance, (see Fig. 5.) Air is brought in and forced out through the motor bases and openings in the end plates, so that the fresh air which enters at one end of the motor passes over the starting resistance first. The escape of air is facilitated by a number of openings in the end plate, Fig. 4, and by two spaces in the casing which are covered with perforated sheet. Through these two openings the switch and starting apparatus can be inspected. If it is possible that water or dust may enter the motor, these openings may be closed by solid plates. When the air is drawn in from the outside atmosphere all openings are hermetically sealed and the air passes in and out through the motor feet, connection being made to special channels in the foundation. In such a case slide rails of a special design are used.

Heavy-duty Motors

It will be seen that the totally inclosed motors above described are fit to go into the most fiery part of a colliery, and are useful for work such as dip pumping, coal cutting, haulage, etc. For larger work such as a long rope haulage, district ventilation, etc., the problem of total inclosure would be a very serious matter. In such cases it is customary to provide special ventilation and thus eliminate the possibility of any gas accumulating. For example, most underground electric haulages of large size have special chambers prepared for them; by a suitable arrangement of brattices, etc., a sufficient supply of fresh air can usually be secured to insure such a chamber being kept free from firedamp. This, with the precaution of placing such motors and their switch gear in a safe portion of the mine appear to be considered the best practice.

Fig. 6 shows a typical three-phase haulage motor for heavy duty. The chief points in the design of such motors are that the shaft center should be kept low so as to reduce vibration in running to a minimum. The bearings should be an integral part of the motor, mounted on the same bed plate, and long and well lubricated to avoid dropping of the rotor with respect to the stator. In the illustration a cast box bed plate is shown; some makers build these up out of mild-steel girder sections, a very satisfactory method. The speed should be moderately low, if this is consistent with moderate cost, and the motor should have simple gear reductions, in order to reduce wear and vibration, especially where constant starting, stopping and reversal which involve heavy strains if the inertia of the revolving portion is too great. The windings should be amply protected by end shields against mechanical damage, but ventilation should be thoroughly safeguarded. Some motor manufacturers provide ventilation plates in the stator in order to obtain a good air circulation. The stator windings are frequently threaded through closed or nearly closed slots instead of being former wound to give increased protection; soldering should be dispensed with as much as possible, or at any rate reinforced by careful riveting. The rotor slots are preferably placed in tunnels or inclosed slots.

In the design shown in Fig. 4, the col-

lector rings are shown placed between the bearings and the rotor, but an arrangement frequently adopted is to place these rings and their brushes, with some form of short-circuiting and brush-lifting device, on the portion of the shaft extending beyond the bearing, and to cover them over with a casing which is made as dust and gas proof as possible. This, with careful attention to thorough electrical insulation in all parts of the circuits constitutes the precautions which have been found necessary in motors of this size and type.

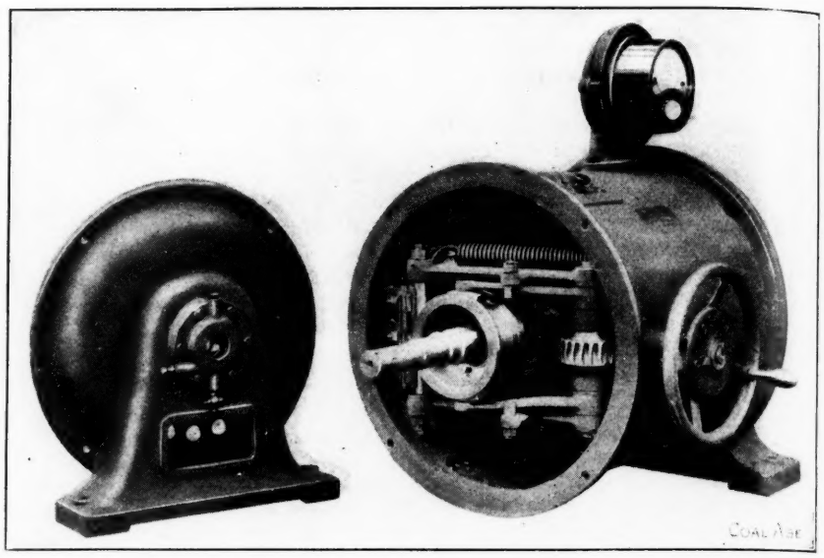


FIG. 4. MOTOR WITH COLLECTING RINGS BETWEEN BEARINGS AND ROTOR

THE CASCADE MOTOR

An alternating-current, variable-speed motor, which has been extensively adopted here for mining work, is the Cascade motor, of the Sandycroft Foundry Co., Ltd., of Chester. It is an induction motor and in its simplest form any variation of speed can be obtained by rheostatic control, the resistance being connected to the stationary windings and the short-circuited rotor having no slip rings.

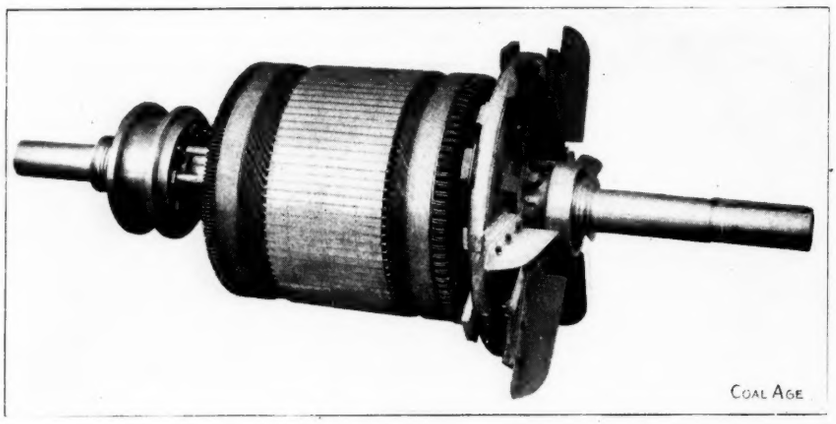


FIG. 5. ARMATURE WITH FAN DIRECTLY BEHIND THE ROTOR

Fig. 7 shows the Cascade stator diagram. The stator carries a single winding, is provided with terminals for connecting to the supply mains, and with tappings which are connected in pairs through resistances while starting or when rheostatic speed control is desired and which are short-circuited at normal speed. The rotor is provided with short-circuited windings without slip rings, unless designed to run at more than one speed.

The motor may be looked upon as two transformers in series, the secondary of the first and the primary of the second being carried by the rotor, and the primary of the first and the secondary of the second being carried by the stator. With this arrangement it will be seen that the currents induced by the rotor are reflected back to the stator, the necessary rotor counter e.m.f. being generated in the process. It is, therefore, possible to control the starting currents by resistances connected to the stator instead of to the rotor. It is also possible by the same means to do away with the necessity of slip rings or any rubbing contacts on the rotor. Tests show that these machines take slightly less current for starting than do "slipring" motors under the same conditions.

CONSTRUCTION OF THE CASCADE MOTOR

The general construction of the motors follows standard practice for "squirrel-cage" machines. The stator windings are of the "barrel" type, and the only difference between them and the windings of a slipring motor is that for the Cascade machines, two windings are connected in parallel. By this means it is possible to connect resistances to points which are

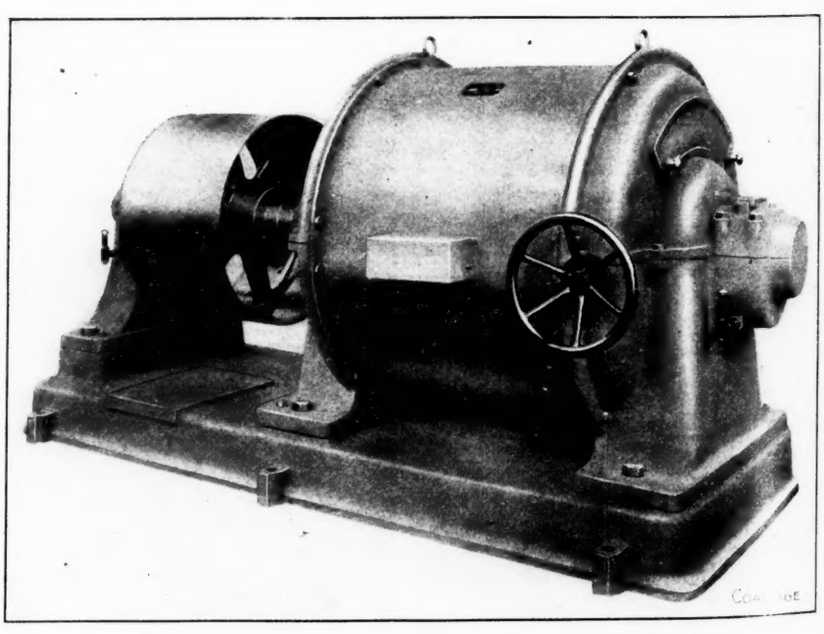


FIG. 6. TYPICAL THREE-PHASE HEAVY-DUTY HAULAGE MOTOR

at equal potential as regards the primary currents and at maximum potential as regards induced currents. The stator winding consequently carries two distinct currents, the primary at line frequency, and the other a current produced by the rotor flux at a frequency depending on the slip.

The heat losses in the copper are equal to the sum of the losses due to the two individual currents, and are less than would be due to one current only of the same total amplitude, e.g., supposing we have two currents, one of 10 amp. and one of 5 amp., and the resistance equals 1 ohm, the total loss would be 100 plus 25 watts. If these had been one current at 15 amp., the loss would have been 225 watts. For this reason the efficiency of these motors is high, and the depth of slots shallow.

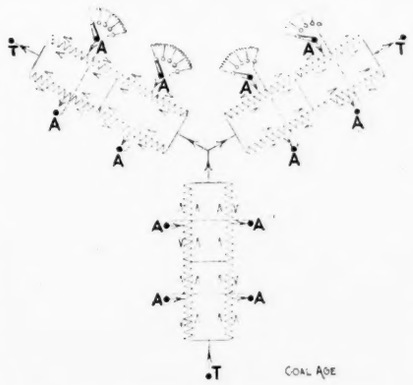


FIG. 7. CASCADE STATOR DIAGRAM

The rotor winding is of what may be called the "resultant" type. It can be developed on paper by first showing the direction of the currents for one number of poles; the cancelling of equal and opposite currents is then carried out and a "resultant" winding is obtained. Owing to this cancellation, a machine wound for 8 and 4 pole magnetic fields is provided with a rotor winding, the pitch of the end windings being 8 and 12 pole. This results in a very great reduction in the self-induction, and also in the weight of the rotor copper, which is about 70 per cent. of the stator copper. This reduction in the inductance of the rotor results in an improved power factor, and in practice it is found that a 12-pole "Cascade" motor of given diameter and length has a higher power than a "slipring" machine of the same dimensions, and wound for the same number of poles. The efficiency of the "Cascade" motor will also be greater than that of the slipring type.

The Weathering of Coal

British Correspondence

Results of tests showing that steam coal loses very little of its heating value by having been submerged under water. Salt water improves the coal.

When the enormous quantities of coal, which are always kept in store for naval purposes, are taken into consideration, it seems remarkable that more attention has not been paid to the subject of the weathering of coal. An admiral of the British Navy asserted some years ago, that from his experience he had found that a vessel would have to consume more than twice its normal amount of coal per indicated horsepower, if the same had been kept too long in store. Strange to say, two years previously to that time a United States naval commander stated that experience had taught certain dealers of New York City that every time coal is handled there is a depreciation of 5 per cent. in value, due to the loss in weight as a result of the breaking up of the coal and the consequent volatilization of the hydro-carbons. It was also observed that the best coal does not disintegrate and lose power so rapidly as the poorer grades.

It is now generally acknowledged that coal when exposed to the atmosphere deteriorates in value and further, coals vary considerably in their susceptibilities to such action. Much depends on the physical structure of coal, as well as the constituents. While it is generally conceded that coals containing a high percentage of volatile matter are least able to resist the effects of weathering, those having the same chemical composition are not always affected alike. This is due to the differences in the physical characteristics of the coal.

Fuel for naval purposes should have the following points clearly determined:

(*a*) Calorific or heating power.

(*b*) Percentage of mineral matter.

(*c*) Resistance to deterioration when exposed to the weather.

(*d*) Smoking properties during combustion.

(*e*) Ultimate and proximate analyses.

For a coal perfectly suitable to naval purposes, that obtained in the Welsh and Scotch coal fields, cannot be equalled by any other coal field in the world. But even with such an excellent reserve, it is still of paramount importance to the British navy to have a record of the qualities of coal available in other fields, together with a comparison of these with the Welsh and Scotch fuels.

TESTS AT NEWPORT DOCKS, WALES

In view of the importance of this problem, it is interesting to record the result of some experiments carried out by John Macaulay, of the Newport Docks, Wales. In loading coal by a hoist, a lump occasionally falls into the dock, which settles to the bottom and is periodically dredged. The coal thus recovered, after lying from three to six months under water, was found to burn well.

To prove this more completely, Mr. Macaulay had a quantity of coal placed under water, in a suitable vessel, for two months. At the end of that time an estimate was made of its calorific power, and compared with one made before immersion, the two samples being carefully taken from the same block of a typical Monmouthshire steam coal. The loss was less than 1 per cent., or, to be quite accurate, 0.8075.

The correctness of his conclusions was later confirmed by the Admiralty authorities, but Mr. Macaulay was not satisfied. He regarded the general proofs as hardly conclusive, and therefore some practical tests were made. Coal known to have been submerged for different periods of time was obtained, together with fresh fuel, and, as far as possible, the conditions were the same for each trial. Four coals were taken as follows: (1) Best Monmouthshire coal; (2) coal submerged in water for three years; (3) coal submerged in water for 10 years; (4) coal recovered outside of mouth of the Usk River. This could be truly called river coal and had probably been under water considerably over ten years; it was in the form of rounded boulders, some portions of which were covered with barnacles.

These coals were tested in a locomotive known to haul a certain load a prescribed distance under ordinary running conditions. The order in which the coals came out of the tests was: (1) The river coal; (2) coal that had been under water 10 years; (3) fresh coal; (4) coal that had been 3 years under water.

Thus the oldest coal gave the best results; the steam raising was prompt and sustained, the fire an ideal one, and the consumption per square foot of grate area as near the theoretical factor of complete combustion as possible. A comparison of the values showed that the river coal was 4 per cent. better than the freshly mined. That which had been under water ten years was 1.8 per cent. better and that which had been under water three years had lost 1.6 per cent. in value.

Results of Tests

It has been urged against the use of submerged coal, that being wet this would heighten the danger of storage in a ship's bunkers. This may be the case theoretically, but apparently does not hold true in practice; as a matter of fact, after exposure for 12 hours to the heat of a summer sun, they were quite dry. Dealing with the matter broadly, the following conclusions have been definitely established:

That steam coal loses very little of its power by submersion under water for the length of time it would be reasonably kept in a naval store.

That as the full working power of a naval vessel is due directly to the coal, subaqueous storage is advisable in preference to the present method of storing with free access of air.

If the salt in the sea water is in any measure accountable for the improvement in the coal, possibly the addition of more salt would improve the submerged coal in less time.

The following data as to the weathering of coal when not submerged throws some further light on the subject. These tests took place on coal that had been stored for twelve weeks in the climatic conditions usually prevailing in the Bengal province. The seam from which the coal was taken is noted for its uniform quality, and when freshly mined its evaporative power equalled 12.57 lb.

After having been exposed for 12 months, two samples (*a*) and (*b*) were taken, the former from the outer layer and the latter from a depth of 4 ft. below the surface. Sample (*a*) gave an evaporative power of 10.89 lb., showing a loss due to weathering of 13 per cent.; the evaporative power of (*b*) was 12.7 pounds, or a loss of 2.3 per cent.

Another sample of Indian coal was made up of a mixture of slack and nut. The thickness of the sample was from 5 to 6 in., and it was subjected to the weather conditions usually prevailing in Bengal from September to November. During this exposure of 56 days, the loss due to weathering amounted to 6.6 per cent.

A third sample of Indian coal was powdered and passed through a No. 60 sieve, after which it was stored in a dry room. The loss from an exposure of 56 days equalled 7.5 per cent.

A sample of English coal in the form of small nut and taken from near the outcrop was tested. When freshly mined the coal had an evaporative power of 14.99 lb., while after an exposure of 130 days this was only 10.9 lb., showing a loss of 26 per cent.

The Illinois University has also conducted a number of experiments with regard to the storage of coal under water and the following is a summary of their results: (*a*) Submerged coal does not lose appreciably in heat value. (*b*) Outdoor exposure results in a loss of heating value varying from 2 to 10 per cent. (*c*) In most cases the losses in storage appear to be practically complete at the end of five months; from the seventh to the ninth month the loss is not appreciable. These data are, of course, as far from being conclusive as those of the Newport experiments, and there seems to be a good field open for investigations on this subject.

Electric Lamps for Miners

Owing to the generosity of a colliery proprietor, the Home Department of the British Government was enabled to offer a prize of $5000 to encourage the production of safe and efficient types of electric lamps. The award was open, and the honors were to be carried off by the lamp which best fulfilled the following specified requirements:

(1) Each lamp was to be of sound mechanical construction, so as to withstand rough usage.

(2) It was to be of simple construction and easy to maintain in good order and repair.

(3) It was to be so constructed as to render impossible the ignition of inflammable gas either within or without the lamp.

(4) The lamp battery was to be so constructed that any liquid it might contain could not be spilled with the lamp in use.

(5) The lamp was to be so constructed as not to be liable to deterioration by corrosion as a result of the electrolyte.

(6) It was to be effectively blocked.

(7) It was to be capable of giving not less than two candlepower continuously for ten hours.

(8) The light was to be well distributed outside the lamp.

In addition to the foregoing conditions, attention had to be paid to first cost of the lamp, cost of maintenance, convenience in handling, and weight when charged and ready for use.

The judges appointed by the home offices had 195 lamps submitted to them, and the first prize has been awarded to the C. E. A. G. lamp, sent in by F. Barber, Beurhausstrasse, 3, Dortmund, Germany, who has been granted $3000. The remainder of the prize money has been equally apportioned in amounts of $250 to eight other lamps possessing considerable merits, and which were sent in by Thomas Attwater, 22 Pelham Square, Brighton, England; Adolph Bohres, Zietenstrasse 12, Hanover, Germany; Bristol Electric Safety Lamp Works, 40 Great Smith St., Westminster, London; Electrical Co., Ltd., 122-120 Charing Cross Road, London, W. C.; W. E. Gray, 19 Archer St., Camdon Town, London, N. W.; H. F. Joel, 134 B Kingsland Road, London, N. E.; Oldham & Son, Denton, Manchester; Tudor Accumulator Co., 119 Victoria St., Westminster, London, S. W.

The judges were Charles Rhodes, a former president of the Institute of Mining Engineers, and Charles H. Merz, an electrical expert who was a member of the recent departmental committee on the use of electricity in mines.

The Abernant Explosion

By Robert Gibson*

The Abernant mine is situated 28 miles from Birmingham, Ala. On Aug. 13 an explosion took place, killing 19 out of the 40 white men and 18 negroes in the mine at that time. Apparently the explosion occurred in No. 5 entry and seems to have been due to the ignition of firedamp.

It appears that the negroes did not believe the matter at all serious, as the air in which they then were working continued good after the explosion. They gathered together and discussed the situation. One of the rescued negroes, by the name of Will Yancy, said: "We all sat down and talked over the matter. The air was good where we were and we reached the conclusion that the trouble was not serious. It was very dark, however, and all of a sudden one of the men who had grown fearful in the face of the danger suggested in a loud voice that we get out.

"This produced a panic, the bunch scattered and I was left behind with one other man. We were determined to work our way out and started, but soon found the air was so foul that we had to retreat. Three times we made the attempt and each time were forced back to the starting point.

"In some manner we became separated, but I was lucky enough to strike a road in which some air was moving and was saved. The body of the other man was found the next morning." The foul odors resulting from decomposed mule flesh made the work of rescue most nauseating.

On account of the danger of a second explosion following on the heels of the first, the investigating work was conducted with great care. Mr. Nesbitt, chief mine inspector, will submit his report to the governor some time this week with certain recommendations. It is the general opinion that most of the men died from suffocation by afterdamp.

Acid Water in Mines

The leading cause of corrosion in mines is the presence of sulphates of iron and sulphuric acid. Steeping the pipes, at a red heat, in coal tar has proved moderately good as a protection for pumps from the action of sulphuric acid. An enamel glaze provides an effective protection for the working barrels and valves.

*Helena, Ala.

Method of Ventilating R. R. Tunnels

Description of ventilating methods employed in the Weehawken tunnel of the West Shore R. R. The problems of railroad tunnel ventilation are somewhat different from those encountered in mines. The system here described has a large capacity and introduces a number of novel features unfamiliar to the colliery engineer.

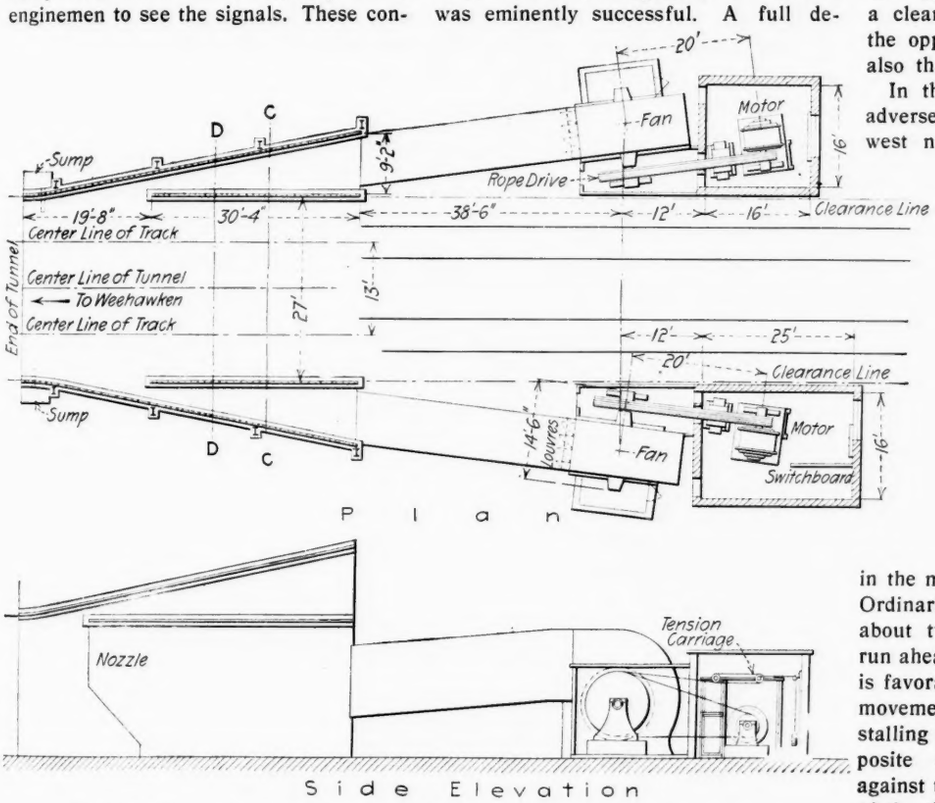
Note—Paper appearing in the "Railway Age Gazette, Aug. 9, 1912.

The West Shore has recently installed a Churchill system of ventilation at the west portal of the Weehawken tunnel, through the palisades between Weehawken and New Durham, N. J. The tunnel is a double-track bore 4225 ft. long and has a cross-section of 507 sq.ft. The width is 27 ft. and the height above the base of rail 19 ft. 6 in. All of the freight and passenger traffic of the West Shore and New York, Ontario & Western railways passes through this tunnel. This traffic had become so dense that the tunnel was practically never free from smoke.

The result has been that aside from the annoyance to train crews and passengers resulting from the fouled condition of the atmosphere, innumerable delays resulted from the inability of the enginemen to see the signals. These conditions have been growing gradually worse, until it was decided that some system of ventilation was needed and the Churchill was finally selected.

The principle of this method is to surround the tunnel portal with a nozzle, through which air is blown into it. This entering air acting on the principle of an exhaust nozzle of a locomotive, entrains the air with which it comes in contact and creates a draft through the tunnel, carrying the smoke and foul air with it.

This system of ventilation was first applied to the Elkhorn, W. Va., tunnel of the Norfolk & Western, of which Mr. Churchill is chief engineer, and where it was eminently successful. A full description of this installation was published in the *Railroad Gazette* for May 10, 1901.



PLAN OF TUNNEL PORTAL, SHOWING LOCATION OF FANS AND NOZZLES, WITH ELEVATION OF ONE FAN AND NOZZLE

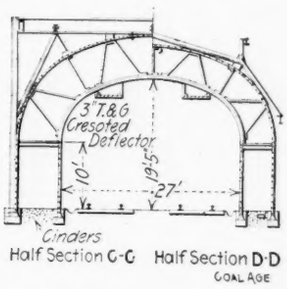
RESULTS OBTAINED

The West Shore tunnel contains about 2,142,000 cu.ft. of air and two fans have been installed, each with a capacity of 275,000 cu.ft. of air per minute, or 550,000 cu.ft. for the two. This latter volume of air is delivered under a pressure of 1¼ oz. at the discharge orifice of tunnel nozzle when the two fan sets are operating together.

Under normal working conditions the tunnel will be cleared of smoke and gas in from 4 to 5 minutes, so that the induced current has a velocity through the section of from 10 to 12 miles per hour. This time, however, varies with atmospheric conditions, and damp, murky weather or a strong east wind blowing in at the east portal may have such a checking effect on the speed of the air that the time of clearing may be extended to from 10 to 12 or even 15 minutes.

At the Elkhorn tunnel on the Norfolk & Western there is an adverse grade in the direction of the flow of air, and it is customary to run the trains slower than the current, so that all smoke is swept on ahead of the locomotives and the engineman is at all times working in a clear atmosphere. When running in the opposite direction this is, of course, also the case.

In the West Shore tunnel where the adverse grade is only 0.3 per cent. going west no attention will be paid to this



in the movement and operation of trains. Ordinarily a train will run through in about two minutes and will, therefore, run ahead of the smoke, and as the grade is favorable in the direction of the smoke movement there will be no danger of stalling in a bad atmosphere. In the opposite direction the locomotive runs against the current and is in clear air all of the time except as it happens to meet a train.

The fans are located about 100 ft. outside the west portal of the tunnel and on either side of the tracks in small buildings of reinforced concrete. The ducts between the fan housings and the nozzle are also to be constructed of reinforced concrete.

DESCRIPTION OF THE PLANT

Each fan is driven by a rope drive leading from a pulley on the armature shaft of the motor. They revolve at a speed of 158 r.p.m., while the motors run at 600 r.p.m., the diameter of the two pulleys being 114 in. and 30 in., re-

spectively. The outside diameter of the fans is 132 in. and the width of the blades at the periphery is 66 in. They deliver directly into air ducts leading to the nozzle, taking air through an inlet 134 in. in diameter and delivering through an outlet measuring 93x88 in.

The weight of each fan in working order without motor, duct or sheave, is about 14,000 lb. The overall width parallel to the shaft is 14 ft. 4 in. Each fan is inclosed in a heavy circular steel plate casing, and at the lowest part of the same there is a connection to the sewer so constructed as to avoid any leakage of air. The casing is also provided with an air-tight door, giving easy access to the interior. Each fan shaft, which is 6 in. in diameter, is provided with three bearings each of which has a length of four diameters.

The capacity of the fans is measured by Pitot tubes inserted in the ducts between the fans and the nozzles, which are in the straight section of the discharge.

The guaranteed efficiency of the fans is as follows:

Air, cu.ft. per min.	Pressure, oz. per sq.in.	Speed r.p.m.	Brake, hp. at fan pulley	Mechanical Efficiency
Only One Fan Unit Running.				
68,750	....	38	...	.....
137,500	.10	75	30	45 per cent.
275,000	.35	145	215	50 per cent.
Two Fan Units Running				
137,500	....	38	...	.....
275,000	0.35	75	35	45 per cent.
550,000	1.35	150	220	50 per cent.

In operation the fans run smoothly and without vibration.

This system was installed under the direction of George W. Kittredge, chief engineer; J. W. Pfau, engineer of construction, and R. E. Dougherty, district engineer of the New York Central; Chas. E. Churchill was consulting engineer; Watson-Flagg Engineering Co., contractors for fan houses, ducts and mechanical equipment; F. J. McCain Construction Co., contractors for erection of nozzle.

Mine Telephones

By J. O. Oliver*

It is not generally known how great is the importance of the telephone to the mining industry, connecting as it does in the modern mine, the various operating and working departments which often are located at great distances from one another. There is no other agency which brings together in a more satisfactory manner, these many departments. From a commercial standpoint, such a system becomes invaluable for executing immediately and accurately the many important daily orders from the various operating departments, such as the Superintendent's Office, the Engineering Department, etc., with the foremen and individuals located in the many sections of the plant, both on the surface and underground, these departments being often many miles apart.

The mining property which is making the greatest success today in these times of severe competition, is the one which adopts the most modern machinery and employs the latest and most efficient type of apparatus, with which to conduct the business. The operator as well as the mining engineer, are agreed that there is no more important factor at the colleries, than a reliable system of telephones.

The manner in which such a system should be installed, varies on account of the many conditions to be met and the character of the mine to be equipped. Generally speaking, where the property is of good size and where there are a number of shafts and levels, etc., to be connected, the establishment of an operator's switch-board is advisable. This equipment, as a rule, is located in the General Manager's office, and is under the control of a man of some experience, who is familiar with the operation and the conditions existing in mines.

From this switch-board, as a central point, the various offices of the building are connected, also the different buildings on the surface, such as the engine house, supply house, repair department, breaker, hospital, etc. Usually these points have their own private line, or in other words, one telephone station, connected to a pair of wires. A cable is run from this same central point, consisting of a number of pairs of wires, the size of which is to be determined by the number of instruments or stations, ultimately to be installed. This cable extends to the entrance of the mine or shaft opening, and thence to the inside; it is thoroughly weather-proofed in order to withstand dampness and the mine gases. This cable is often lead covered.

Following the slope or main entry, as the case may be, one or more pairs of wires are taken from the cable at the various levels thus allowing telephone stations to be located and connected at these points; in a like manner, additional instruments are located at points found advisable throughout the mine. The main cable continues on through the mine, dropping off a pair of wires here and there, as found advisable. In this connection, it might be well to state that it is not necessary to have a pair of wires for each telephone installed. On the contrary, it is common practice to connect a number of telephones to a single pair of wires, each station being called by a code of signals, such as one long ring for station one, two short rings for another, etc. There are often 10 to 20 stations thus connected to a single pair of wires. It is not advisable, however, to use more than 10 on any one circuit, or the line will be so busy that the service will be poor.

From a standpoint of safety, the modern telephone system is of supreme importance, regardless of whether the mine be of small or large proportions. It is not only often the means of preventing accidents, both to life and property, but when such do happen, it is invaluable in securing the help which is so necessary at such times. With a thoroughly well installed system of telephones, of a reliable type, especially designed and built for the severe conditions existing in mines, the Manager and Superintendent can rest assured that they have done everything in their power, to protect the lives of their men and the property of the company.

*112 N. Broad St., Philadelphia, Penn.

A Simple Method of Jacketing a Revolving Screen

By Benedict Shubert*

Very often in changing the product of a revolving screen, or in reducing the amount of screen space so as to pass more fine material over the screen, there is considerable delay caused by changing the screen plates or by putting on steel jacket plates.

A very simple method of jacketing a portion of the screen is to wrap it with manila rope. There is always a large amount of old manila rope lying around every mine and this can be quickly wrapped around any portion of the screens so as to close as much, or as little, of the openings as may be desirable. The rope can be wrapped quickly by fastening the rope at one point and then starting and revolving the screen slowly, allowing the rope to wrap itself around the screen cloth.

This method is quick and simple and the materials are always at hand.

Cost of Coal

In figuring the cost of operation of a steam power plant for a large cotton mill in New England, Lockwood, Greene & Co., architects and engineers for industrial plants, Boston, recently have placed the cost of coal at just 75 per cent. of the total direct operating cost, exclusive of capital charges. The figures given for one year's operation are as follows: Coal, $32,985; labor, $6893; oil, waste and supplies, $4100, making a total of $43,978.

Air-dried peat is an excellent fuel not only for domestic purposes, but also for power production. In the peat gas producer it has given excellent results. Peat yields a fine nonclinking ash that easily passes through a grate.

*Boston Building, Denver, Colo.

A Graphic Solution for Engine Plane Loads

By Arthur O. Gates*

In hoisting with skips from deep inclined shafts or hauling trains of cars on flatter inclines, the effect of the inclination is to make the pull on the rope less than the total weight handled. This reduction in rope pull allows greater loads to be handled, and the accompanying diagrams are for the purpose of determining at a glance the rope pull due to a weight of 1000 lb. gross when operating on the various angles and grades shown.

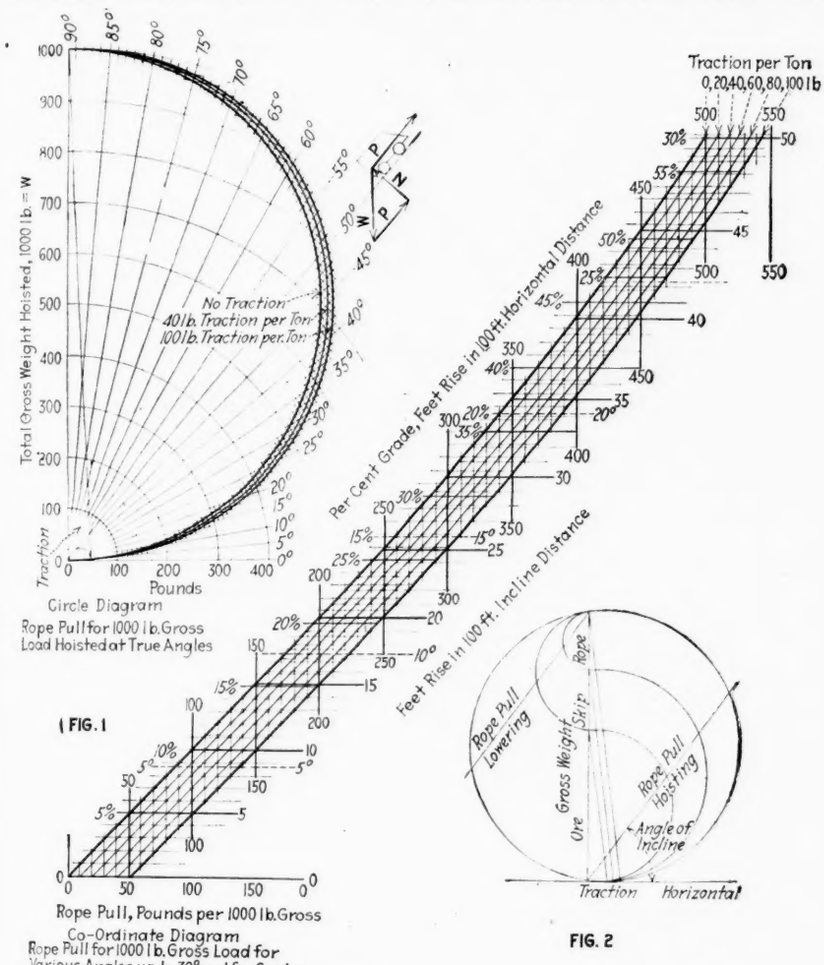


Chart for Solution of Forces in Hoisting on Inclines

When a load W is supported on an incline, the actual support consists of two components, a normal force N at right angles to the track, and a force P, parallel to the track. The resultant of these two is, of course, equal and opposite to W.

The circle diagram developed from this relation is rather interesting, depending on a simple geometrical law which can be stated in several ways. Given a series of right triangles with a common hypotenuse, the intersection of the right angles will lie on a circle the diameter of which is the hypotenuse. Stated another way: If from any point on a circle, straight lines be drawn to the opposite ends of a diameter, the included angle is a right angle.

It will be noted that the gross weight $W = 1000$ lb. has been plotted as the vertical diameter of the circle and is the pull P when the angle of inclination is 90°. At any other angle than 90° the pull P is measured by the distance from the lower end of the diameter to the intersection of the circle and the line drawn at the true angle, measured of course on the same scale as the vertical diameter. Thus with a gross load of 1000 lb. on an incline 47° from the horizontal the rope pull due to weight alone is 730 pounds.

On inclines the effect of friction of the wheels on the rails is to increase the rope pull when hoisting, and to decrease it when lowering. This friction or "traction" varies between certain limits; from 15 to 20 lb. per ton normal pressure on the track when track and skip or car are in the best of condition, up to 40 lb. and 60 lb. and even more under bad conditions. This traction is proportional to the normal force on the rails and its value can be shown graphically by another circle diagram, this time with the diameter horizontal and equal to the traction on level grade as shown at the bottom of the circle diagram, the traction of 50 lb. for the 1000 lb. gross load (100 lb. per ton) has been laid off horizontally and the circle drawn. The length from the corner to the intersection of this circle and the angle line measures the traction for this inclination.

The combined rope pull due to load and traction is obtained by laying off a new circle on the hypotenuse connecting the ends of the vertical, gross-load line and horizontal, traction line, the incline angles being laid off from the bottom of the vertical, gross-load line. For the rope pull when lowering, lay off the inclination from the upper end of the vertical, gross-load line.

The lengths of these lines to their intersection with the circle gives the rope pull hoisting and lowering as in Fig. 2, which figure also shows the partial loads due to ore only, skip or cars only, and rope. The circles for lowering rope-pulls of rope and combined rope and skip have their centers on the diameter of the big circle.

For a specific problem, lay off the different gross loads vertically as in Fig. 2, the corresponding tractions horizontally, and the exact rope pulls may be read off directly to scale. In case the incline changes its direction, the rope must be divided into several parts, the weight of the section of rope nearest the skip and on the same inclination, together with skip and ore are combined on the circle diagram, and the pull of the rope on other inclines added. There are several ways that this may be diagrammed, but anyone familiar with the schemes as outlined need have no difficulty in determining rope pulls for any combination of inclines.

On the flatter grades, the effect of traction is more marked, so for purposes of accuracy that part of the circle diagram under 30° has been plotted to coördinate on a greater scale and which we will call the coördinate diagram. Horizontal distances represent rope pulls when the gross load is 1000 lb., vertical distance marked above the curve indicating per cent. grade or rise in feet per 100 ft. horizontal distance; vertical distances marked below the curves, feet rise per 100 ft. along the incline.

The simplicity of the circle diagram and the ease with which it can be remembered makes one wonder if this method has not been used before, although no previous use of it has come to my observation. At any rate the curve shows how nicely the graphical method often gives a physical conception of the effect of variation.

*Mining engineer, 1017 State St., Lafayette, Ind.

Note—Abstract from the "Engineering and Mining Journal," Aug. 17, 1912.

Who's Who—in Coal Mining

Devoted to Brief Sketches of Prominent Men, Their Work and Ideas.

The man who will work for others as if he were working for himself will soon have the real pleasure of actually being in business on his own responsibility. Harry N. Taylor, of Chicago, started life with this principle in mind, and he has realized in full the truth of the doctrine.

He believed that the greatest thing a man can do is to make the most possible out of the stuff which has been given to him; that this is success, and that there is no other. His idea was that every occasion is great enough to demand our best work, our highest efforts, and that our ideal ought not to be "that he who does not excel all others fails, but that he who does not do the best he can, is a failure."

Born at Columbus, Ohio, in 1865, Mr. Taylor entered the employ of the Old Columbus Hocking Coal & Iron Co. in 1881 when only 16 years of age. His first position was that of yard clerk, and the next four years were spent in the service of this same company, filling subordinate positions which had more hard work and practical experience attached to them than any recompense in the way of a munificent salary.

In 1885, when 20 years old, he was appointed manager of the Sunday Creek Coal Co. (local department). Two years later, Mr. Taylor was sent to Milwaukee to represent the Sunday Creek Co. as their general Northwestern agent. In this position he had charge of the shipping docks at Milwaukee, and also managed the sale of Sunday Creek coal on the Great Lakes.

Four years later (1891) he became general Western agent for the same company in Chicago. Through all these years Mr. Taylor applied himself diligently to his work, and, although young in years for the responsible position he held, commanded the respect and confidence of all those with whom he came in business contact. The selling end of the coal business, which, by the way, is not the least important side of this great industry, became as an open book to him, and there is no doubt but that his ultimate success was due largely to his knowledge of just how to dispose of the product of his mines.

In 1891, shortly after he had been transferred to Chicago, he became interested in the Wilmington coal field of Illinois, and in 1895, left the employ of the Sunday Creek Coal Co. to become general manager of the General Wilmington Coal Co. (a selling company for the allied interests of the Wilmington coal field). His connection with this latter company continues to the present day.

H. N. TAYLOR

Since starting in the mining business for himself, Harry Taylor's interests have spread until he has become one of the largest figures in the coal business in the Middle West. He is president of the Western Coal & Dock Co., which concern operates bituminous and anthracite shipping docks at Waukegan on the E. J. & E. R.R. He has been a member of the executive board of the Illinois Coal Operators' Association continuously since its formation in 1898, and has acted as a spokesman for the Illinois coal owners in all their scale-making deliberations with the miners since that date.

In 1910, Mr. Taylor was elected president of the Illinois Coal Operators' Association, and in 1912 he became president of the American Federation of Coal Operators. He is vice-president and general manager of the Northern Central Coal Co., owners of 47,000 acres of coal land in Missouri and operators of mines and washing plants in that same state. He is also president of the Monon Coal Co., the largest operating concern in Indiana, and president of the Big Jo Block Coal Co. in Iowa. In addition to these many important offices, he is general manager of the Big Four Wilmington Coal Co. in Illinois.

Through the management of large mines in four states, H. N. Taylor has acquired a broad experience which has fitted him perfectly to bear the burdens of leadership in the frequent struggles between the representatives of the miners' union and the coal owners. The lack of unison on the part of Illinois operators, due to the varied opinions and limited resources of the multitude of small independent owners in that state, has made the road of Harry Taylor, as spokesman for the operators, a rough and hilly one to travel.

His struggles with labor, therefore, have not always met with a favorable outcome, but in every battle he has proved himself a worthy foe; to him failure is only experience, and experience is equipment. When defeat to a man is but a means whereby he can discover some form of error to be avoided afterward, then such failure is nothing less than a stepping-stone on the path to success.

Mr. Taylor's strength is the kind that must be measured by the power of the feelings he subdues; his strength of character is indicated by strong feelings and strong command over them. Vigorous of head, hand and lungs, the weighty burdens have fallen to him, but where the heavy burdens fall, the great prizes fall, also.

In our daily life indecision soon becomes a disease, and procrastination is its forerunner; however, this malady will never attack Harry Taylor, for he firmly believes that the energy wasted in postponing until tomorrow a duty of today would often do the work.

Of all his personal qualities that have helped him build a name and fortune for himself, no other characteristic is more responsible for his success than his habit of prompt, energetic decision. When his ultimatum is given, the question is not brought up for reconsideration every time opposing arguments are presented. He believes it is better to make a mistake by deciding too quickly than to be forever vacillating, not knowing what to do, and contends that when a man lacks decision he is at the mercy of circumstances, and the puppet of stronger minds.

The coal problems in Illinois are difficult of solution and the operators have sought by the installation of improved machinery to meet the pressing demands of increasing competition. They are to be congratulated that they have in H. N. Taylor a man who can restrain the excessive demands of labor.

Mining and the Respiratory Organs

Editorial Comment

Those occupations which foster the generality of diseases of the respiratory organs also foster tuberculosis. The ironstone miner has less disease of the respiratory organs than the coal miner, though he is more subject to tuberculosis. The figures of the U. S. Census must be used with great caution and should be calculated on a more scientific basis.

We complete today in our Sociological department the third article of Wainwright and Nichols on the relative freedom of the coal miner from tuberculosis. Reading all their remarks carefully we are compelled to approve them as sound and true and a valuable contribution to the literature of the subject. Especially excellent are the remarks on the bacteriology and histology of lung affections.

Yet a study of recent statistics suggests that certain statements need modification. The authors ask us to grant that the tuberculosis death rate for miners and quarrymen must be higher than for men not engaged in coal mining. This to a reader of modern literature relative to occupational diseases would seem abundantly fair, a postulate to be granted without demonstration.

The Popular Notions Based on Local Conditions

Yet it is possibly not wholly true and may need a careful restatement. Popular knowledge of the relation between tuberculosis and mining prior to the current year come entirely from those places where the disease is rampant, and these localities exercise a wholly false and undue influence on the mind.

We learn that stone dust creates fibrosis in that specialized form known as silicosis, due to the attrition of silicaceous materials on the exterior of the lungs. These suffering organs develop tuberculosis as reports emanating from Cornwall, the Transvaal, West Australia, Victoria and New Zealand reiterate unceasingly.

But looking at the table below, taken from the decennial report of the Registrar-General of England and Wales, 1902, we see that "ironstone" mining, to use the English expression, had also a good record as to pulmonary tuberculosis and a better record than coal mining as to other respiratory diseases. In fact of all dusty occupations, iron and coal mining are the least fatal through the respiratory organs, whereas tin and copper mining stand on the opposite end of the scale.

Carbon Does Not Serve as Well in Outside Work

We have omitted many dusty occupations from this list, giving a preference to some of those more favorable to tuberculosis, but we wish to call attention to "coal heaving" (trucking, shoveling and delivering coal) and to "chimney sweeping" (an occupation of no little importance in a country where all chamber fires are in open hearths and domestic furnaces are rare).

Both occupations favor the coating of the lungs with carbon dust or soot and they should according to all accepted notions safeguard the individual from tuberculosis. Moreover, the men engaged in them are compelled to suffer the agonies of a daily bath and these two conditions should enable the workers to make a successful resistance to the tubercle bacillus.

Not so, however, the coal heaver and chimney sweep have a greater mortality than the slate and stone quarrymen. It must be conceded that the sweep, the "ramoneur" as he chooses to entitle himself, sweeps down fine coal-ash and this may mar the effect of the soot. It seems possible that there are other bodies which are almost as helpful as coal dust in aiding the lungs to resist the progress of tubercular disease. Ground shale rock and fireclay may be such materials.

The Potter's Liability to Consumption

But here the sad example of the potter shows that such conclusions must not be too rashly adopted. The practice of grinding clay in potteries and mixing the material with silica, ground limestone, flints and broken pottery, to prevent undue shrinkage and deformation, may be the reason why the potter is so subject to the disease.

Is it Safe to Sprinkle Shale Dust in Mines?

The subject is important, seeing that we are proposing to sprinkle our headings and ribs with dust, that Watteyne and Lemaire are urging us to put stone dust before all shot holes to blanket their fire and that Taffanel would have us put piles of fine dust on boards at frequent intervals through the mines.

The British government is about to institute inquiries at Eskmeals and Dr. Beattie and W. E. Garforth have already made some experiments regarding the practice of "stone-dusting" which we

DISEASES OF RESPIRATORY ORGANS—ENGLAND AND WALES

Selected Dusty Occupations and Agriculture	Occupied and Retired Workmen: Mortality Figures: Phthisis	Occupied and Retired Workmen: Mortality Figures: Other Res. Dis.	Occupied and Retired Workmen: Ratio: All Respiratory Diseases	Occupied Workmen: Mortality Figures for all Respiratory Diseases 1890–92	Occupied Workmen: Mortality Figures for all Respiratory Diseases 1900–1902	Occupied Workmen: Percentage of Change
Tin miner	816	741	1,557*	1,021	1,577*	154
Copper miner	574	747	1,321	786	1,266	161
Scissors maker	533	315	848	1,040	812	78
Potter	285	473	758	1,155	741	64
File maker	387	325	712	955	691	72
Lead miner	324	274	598	814	588	72
Chimney sweep	284	272	556	638	510	80
Wood turner, cooper	271	233	504	607	483	80
Coal heaver	213	283	496	703	465	59
Cotton worker	197	225	422	623	399	64
Stone and slate quarryman	190	206	396	667	390	58
Bricklayer, mason and builder	194	183	377	551	364	66
Gas works worker	141	214	355	603	344	57
Wool and worsted worker	159	161	320	516	314	61
Coal miner	89	196	285	423	274	65
Carpenter and joiner	150	126	276	378	264	70
Ironstone miner	126	140	266	340	265	78
Agriculturist	85†	86	171	255	161	63

*These figures are correctly copied from the return, but one is obviously incorrect. The number of occupied tin miners should not exceed the number of occupied and retired. †This number is incorrectly quoted in the 11th edition of the Encyclopaedia Britannica as 100.

PROGRESS OF RESPIRATORY DISEASES—ENGLAND AND WALES

Occupied Workers	Comparative Mortality Figures: Tuberculosis 1880–82	Tuberculosis 1890–92	Tuberculosis 1900–02	Other Respiratory Diseases 1880–82	Other Respiratory Diseases 1890–92	Other Respiratory Diseases 1900–02
Coal miners						
Durham and Northumberland	147	116	88	133	170	113
Lancashire	135	125	98	249	402	261
West Riding, Yorkshire	120	145	91	186	284	142
Derbyshire and Nottinghamshire	129	87	67	150	162	107
Staffordshire	111	100	70	283	344	189
Monmouthshire and South Wales	180	132	98	318	350	218
Ironstone miners	154	110	124	224	218	139
Tin miners	749	579	851	497	434	735
Stone and slate quarrymen	335	316	186	298	346	202

hope soon to publish. At Pittsburgh University, inquiry is being made into the action of soot and the preliminary investigation shows that the curse of tuberculosis is most general where the air is freest from smoke.

The authors of the paper we have just published leave one with the unpleasant notion, whether justified and intended or not we cannot say, that tuberculosis and other respiratory troubles are of virtual interchangeability. From the table above it is seen that both appear to be large in the same occupations and from the table which follows both appear on the whole to decrease or increase together as the decades roll along.

The Shortcomings of all Statistics

Further inquiry and experiments are needed and care shoud be taken to put statistics on a safe basis. The English figures are far better than our own, yet Dr. John Tatham, who presents them, calls attention to their uncertain value. Six per cent. of the certificates were furnished by coroners, who doubtless knew nothing of the patients' previous ailments.

Many decedents are afflicted with more than one ill and the physician is at a loss to say which caused the fatality and many times death is only indirectly caused by the real source of the invalidity which ends fatally. In some cases physicians may be still inclined to believe that the respiratory ailings of miners are all to be ascribed to the activity of tubercle bacillus. Moreover, the physicians are careless and use such vague terms as "abscess or congestion of the lungs," "pleurisy" and "hemoptysis," so that tuberculosis is hard to segregate in reporting respiratory diseases.

On the other hand the tin miners and copper miners are too few in numbers to permit broad deductions to be made from a list of their fatalities. And here something of like nature should be said relative to the inadequacy of the figures of the United States Census of 1900 which Wainwright and Nichols quote so freely.

We preface our statement, however, by calling attention to the fact that the census reports of this present decade are shaping themselves more slowly than in the preceding period. The two volumes of vital statistics of the census of 1900 were published in 1902, yet there is no probability that we will see during this current year the results of the work of 1910. So we must still base our conclusions on ancient data.

The Marked Inadequacy of Our Census Figures

The Census reports are hard to understand, but one point must be emphasized. The only state which produced coal in the registration record of 1900 was the state of Michigan. So that, the coal miners whose vital statistics are recorded must be very few and the showing is a tribute rather to the work of other dust than a proof that coal dust is effective as immunizing agent against tuberculosis.

In a year or so we hope that American figures of real value will throw light on the problem in the United States for a laudable attempt is being made in many states to prepare figures suited to the needs of the Census department.

Unless, however, these figures are calculated on a more scientific basis than in the past they will be needlessly unreliable. The method adopted in the English statistics, too complicated to be here described, lays due stress on the age of death which the American statistics ignore. Calculated according to American methods the English agriculturalist in 1900-1902 would appear a worse risk than the average man, yet this is not the case.

The agriculturalist lives to an abnormal age and the deaths of greybeards and patriarchs by the accepted American method swell the annual percentage mortality in a most deceptive manner. The decennial estimates are even more deceiving. So the figures we now have to work with are restricted, do not deal with coal miners and are compiled in a manner which would make them of little value even if they covered the whole population.

Coal Dust and Gas

By Joseph Northover*

It is generally admitted that some of the worst mine explosions that have occurred in the past were caused by an accumulation of coal dust and a small percentage of gas. In view of this fact no mine, or rather no dusty and gaseous mine should be worked without the installation of a general system of watering approved by the mine inspector. In any mine where coal dust accumulates readily, some effectual system of laying and removing this element of danger should be seriously considered. In my opinion, the danger from dust is the greatest danger in mining, today. With rare exceptions, the workings of a mine can be kept clear of explosive gas; but should an explosion of a small body of gas, without the presence of dust, occur it would not do much damage, except in the vicinity of the explosion, unless the afterdamp be carried by the air into other sections of the mine. If a mine is properly ventilated, with separate splits of air, an explosion is localized and the afterdamp of the explosion much better controlled.

It is also a fact that explosions have followed the main airways and traveled the main haulage roads in the best-ventilated portions or districts of mines and have avoided the return airways where the air would naturally contain the most gas. This can be accounted for by the dust theory. The main haulage roads are naturally dusty, and the dust requires plenty of air to support the combustion. For this reason, a coal-dust explosion follows the intake aircourses, and advances against the current. On the return side the flame is quickly snuffed out in its own trail, for lack of air

Coal dust itself is a dangerous element and may be the sole cause of an explosion when acted upon by a flame of sufficient intensity and volume, such as that produced by a blownout shot or a local explosion of gas. The action of the flame distills carbon monoxide gas from the fine particles of dust suspended in the air. The explosion of this gas causes a continuous disturbance of the air and raises a quantity of dust, which liberates fresh quantities of gas, and thus the explosion gains force and magnitude and is transmitted to all parts of the mine where air is present in sufficient quantity.

Explosive gas and coal dust may be harmless of themselves, but under certain conditions and when brought into contact with flame they are often the cause of a disastrous explosion. At all dusty mines a proper water system, for the purpose of thoroughly wetting and laying the dust should be installed. Remove all accumulations of dust from the mine, after it has first been saturated with water. Adopt the system of mining that will produce the least dust.

*Seanor, Penn.

Greasing Mine Car Wheels

By Benedict Shubert*

The efficiency of grease over oil is so marked in mine-car wheels, particularly in the roller-bearing types, that there is a marked loss of economy where oil is used. The difficulty of thoroughly greasing the wheels, however, has prevented the introduction of grease to as large an extent as is really warranted.

There is a simple greasing device on the market consisting of a drum containing about half a barrel of grease, the drum being fitted with a piston which is actuated by either air pressure or steam pressure on one side. This drum is set permanently and two connections are taken from the drum, one to each side of the car track. The cars are run into position and the grease is quickly and thoroughly forced into the bearings, the delay being no greater than if oil were used.

It is usually possible, at most mines, to work out a plan by means of a cut-off airway, whereby the general ventilation of the mine may be reversed without any change at the main intake. This cutoff should be as short as possible and made absolutely fireproof, since, in case of a fire, it may be found desirable to turn the return air through it.

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COAL AGE

Domestic and Small Sizes

When a readjustment of anthracite prices took place at the close of the recent strike, there was no little disgust on the part of the small consumer that he had been "saddled with the whole burden." He could not see why the larger purchaser of coal for steaming purposes had not to bear his part of the increased charge. The burden of his plaint was that the manufacturer was more able to meet that increase than the city clerk or the widow.

So he was. In this statement was summed up almost all the truth of the flood of contentions in which metropolitan dailies indulged. The large purchaser of coal *has* shown an ability to meet the price of small sizes of anthracite, and he has faced it even without the spur which an increased price would have caused. For now he is largely burning bituminous coal despite ordinances to the contrary and regardless of the fact that the anthracite coal companies have asked no increased rate per ton.

The small consumer has demanded a kind of fuel which involves the casting away of much of the general run of the mine. This waste may be offered to the steam users, but the price alone at which it is presented to them, determines whether it will be bought or not. The contracts are not one-sided, the purchaser has his power to decide whether he will buy or forbear.

The strike made little difference to the decision of the big coal users. Only a reduction in price could have held them in line and doubtless the anthracite operators realized that, when they decided to keep steam sizes at the old figures. To meet the situation and keep the old percentage of profits, would have involved an increase of prices on domestic coal.

Today there is a premium of 20c. on stove coal, and egg is also selling above circular prices. Buckwheat, rice and barley, the coal which the power-distributing companies and manufacturers use, are all in abundance despite the general shortage of anthracite coal, and they are all being held well below the prices on the circular.

A readjustment of that document will doubtless be the eventual outcome unless drastic civic action compels the burners of bituminous coal to return to the fuel which economy has urged them to abandon. The action of the anthracite producer in the price readjustment was dictated by the situation and could in no way be regarded as arbitrary.

How would the consumer like to see the steam sizes go to the stock pile and have the whole charge of the mining of coal distributed on 70 per cent. of the output? This is what must inevitably happen if the prices on the other 30 per cent. are made without reference to the demands of the steam market.

Efficiency

There is nothing that is of as great interest to the engineer, superintendent, foremen or boss, as the single word "Efficiency," and yet few words relating to scientific subjects have been more abused. Many intelligent men today have a vague idea of the true meaning of the term.

A miner, at the face, whose daily output of coal averages only two tons, as compared with his fellow, who, working under the same conditions, sends to the shaft 3½ and 4 tons a day, is regarded by his foreman as an inefficient workman. An engine rated at 100 hp. and developing but 50 or 60 hp., in its daily operation of hoisting coal, is styled "low in efficiency." A pump, the stated capacity of which is 500 gal. per min. is inefficient, from one cause or another, when it fails to deliver this amount.

In a general way, efficiency is the ratio of actual service to capacity or ability to produce. In engineering practice, it is the ratio of *output to input*—or the power developed to the indicated horsepower of the engine. The correct expression of the term always refers to the ratio of the power realized to the power expended. It cannot be correctly expressed as a ratio of two *pressures*, or the actual pressure developed to a

certain calculated pressure, since *pressure*, in dynamics, is not an independent term. For the same power, the pressure developed depends on the speed or velocity of the motion. In statics, pressure is a complete term, it being the measure of the applied force. In dynamics, the true basis of comparison is power, and pressures are only proportional, for the same velocity of motion.

This error has been made by prominent engineers, in the past, and the results have led to some confusing statements and ideas. Perhaps, the most glaring instance of this kind is the attempt (which was, we regret to say, for a long time successful) to express the efficiency of a centrifugal fan on the basis of the pressure it developed when circulating air in a mine or airway, as compared with a certain calculated pressure, which, it was assumed, the fan should give at a certain speed. Strange to say, no one, at the time, seemed to realize that the pressure developed by a fan was dependent on the resisting conditions in the airway or conduit into which the fan discharged its air. When there was no resistance there was no pressure; and *vice versa*, a great resistance was indicated at once by a high pressure.

The terms "manometrical efficiency" and "equivalent orifice," as applied to fan ventilation, rapidly fell into disuse when their misapplication became generally known. No one now speaks of the equivalent orifice of a fan, or a mine, except in a limited sense; because the term represents purely theoretical conditions that have no counterpart in practice.

The same is true of the term "manometrical efficiency." It represents the efficiency of a fan, on a formula basis, at one particular mine and no other. At another mine, the same fan running at the same speed, would give a different pressure and water gage and show a different manometric efficiency. The term is, therefore, useless in practice.

Prevention and Cure

The first-aid movement was founded solely to alleviate the injured, but it has already been noted that the rescue corps have created a new spirit. If it is worth while to spend time and energy in reducing the severity of accidents, it is worth more time and energy to avoid them. The enthusiasm of the first-aid men has convinced us that opportunities for safety yet lie uninvoked, and that industrial leaders are to be censured for not having summoned these possibilities earlier into being.

Whenever operators meet, spiteful remarks about discipline, measure their conception of the situation. As a matter of fact, it would be wiser to appeal to the better sense of the more worthy workman, to his knowledge of the duty he owes to his fellows, to the workman's sense of his need for protection against the follies committed by himself and others, and to the inherent activity with which he invariably takes part in social movements of any kind, whether they be good or bad.

If one-half the energy consumed in the condemnation of the mine foreman for some neglect were spent in urging a compliance with the laws of safety among other workingmen, some records might be broken.

How often it is said that the boss is paid for examining places and should do it. As a mattter of fact he is hired as an economic factor, and the law imposes the other onerous duties. The miner is hired to produce coal; the law imposes on him certain duties in addition. There is no difference between the two men. They are both subject to that law; both should obey it. A little censuring would not be amiss for either, as duty is not for any single class of men, but for all, and discipline will never be a success until the workman bows to it himself and demands it of others and will not be denied.

A man has an absolute inalienable right to see that a mine in which he works is made safe. That man is no mere malcontent, who is determined that his fellow-worker shall not jeopardize his life by carelessness and there will be no safe mines if the only guarantee of safety is furnished by the work of the mine foreman, and of those appointed by him. In the future it is to be hoped that we shall find collaboration between two forces which have a common purpose, but which view one another with the utmost distrust.

One Man, One Vote

Within recent years there has been no little fear of arrogant coal trusts and the miners of Great Britain have shown in the last few months how overbearing and politically active a labor trust may be. But we are yet to see whether the miners of England, Scotland and France intend to be yet more arrogant and to deny to the electorate of those countries the rights of free citizens.

At the recent International Miners' Congress, which met at Amsterdam, the British and French delegates desired to discuss the prevention of any wars which the miners might think unjust or inexpedient. They wished to close down the coal mines after the calling of a special International Congress if in their judgment peace is more desirable than war. However, for certain reasons they were obliged to rest content with a simple statement of their views made by the vice-president of the British Federation of Miners.

It must be confessed that the attempt to avoid the horrors of armed arbitraments does the miners no little credit. Yet it must be remembered that the question of peace or war, like all other social questions, should be decided, not by a part of the electorate, but by the whole. Are we to assume that those whose work is at the coal face are by that fact better competent than other mortals to judge for their fellows?

This exhibit of incorporated arrogance is doubtless a mere frenzy. When the time comes for such a congress to be held, it is likely that the war cloud will hover ominously over the assembled delegates, and the first blood will be shed at their alleged pacific deliberations.

On the whole, we doubt very much if the miner is such a statesman that he can lift the burden of the ballot box from a travailing world. Recently we have heard rumors and the sound of falling glass over a proposition to double the electorate, but the British miner and his erstwhile foe, Jacques Bonhomme, have decided that with them rest the wisdom of the ages, and as they decide, the world shall be directed. For their personal advantage and to increase their earnings whole countries, even continents, shall remain idle, and when they would have peace, the world must be satisfied to smile approval on their wishes.

No action was taken at the Congress. The fears of the German delegates prevailed. Political action is forbidden to trade unions in Germany, and the representatives of the German coal-mining associations feared to discuss a question so perilous to the future of their organizations in the Fatherland.

Current Coal Literature

The Best Thought Culled from Contemporary Technical Journals, Domestic and Foreign

Relation Between Chemical and Physical Natures of Coals

By Vivian B. Lewes*

Many classifications of coal have been suggested, some based on their chemical, some on their physical, and others on their coking properties. Of the latter, the most generally adopted is that suggested by Grüner, in which he separates bituminous coals into five classes. Schondorff, Muck and others have shown that it is not applicable to all kinds of coal; still this criticism applies to all classifications which have been proposed, although not of a satisfactory character.

In the third class the action still has continued with further concentration of the resin bodies, hydrocarbons and residuum, with the result that the former bodies are so increased in comparison to the humus and residuum that a good coke results, although for reasons which will be discussed when speaking of coking processes, it is rather too porous and bulky.

In the fourth class the proportion of resin and hydrocarbon bodies has reached the right ratio as compared with the humus and residuum, and the best coking coal is obtained. Bituminous coals of the kind classified by Grüner

CLASSIFICATION OF COALS

No.	Description	Characteristics	Carbon	Hydrogen	Oxygen
1	Dry coal	long flame non-coking	75–80	4.5–5.5	15.0–18.5
2	Fat gas coal	coke, porous and brittle	80–85	5.0–5.8	10.0–13.2
3	Semi-fat or furnace coal	good coke but porous	84–89	5.0–5.5	5.5–10.0
4	Coking coal	high grade coke	89–91	4.5–5.5	4.5–5.5
5	Lean coals and non-coking anthracite		90–93	3.0–4.5	3.0–4.5

This arrangement shows not only the coking properties but also the changes in composition which the coal undergoes, the concentration of carbon and reduction of oxygen in highly oxidized bodies.

Humus-like Bodies in Excess

In the first class we have the dry coals, yielding large volumes of gas and liquid products on distillation, and these, as might be expected, most resemble the lignites, and share with them the property of non-coking or binding together of the residue on carbonization.

This is due to the fact that the humus-like bodies are still present in much larger quantities than the resinic compounds and hydrocarbons, and as on distillation they leave no binding material in the residue, the resinic bodies cannot supply enough to give more than a friable mass.

Resins and Hydrocarbons More Concentrated

In the second class of coals, altered conditions of temperature, pressure and time have led to further decompositions of the humus bodies, and the resinic constituents and hydrocarbons having increased in ratio by concentration, a point is reached at which coking takes place, may, therefore, be looked upon as an agglomerate of humus and the degradation products of these bodies down to carbon, luted and protected by resin bodies and their derivatives.

Steam coals and anthracite are the degradation products of humus which has nearly completed its decomposition owing to the small quantity of resin bodies in the original vegetation. Cannel coal consists mainly of rosin bodies, which having been in a semi-fluid condition have mingled with the earthy matter in contact with them, so obtaining the high ash found in many kinds.

In putting forward this theory as to the composition of coal I wish it distinctly understood that by the terms "humus" or "resin" bodies I do not imply any one distinctive compound, but merely bodies of this character, the humus bodies all containing a percentage of hydrogen from 5 per cent. downwards, while the resin bodies all contain a percentage of hydrogen above 5 per cent.

If it is once admitted that coal is a conglomerate of the kind I have indicated, it explains all those obscure points which no other theory touches, such as why with two coals of almost identical composition and of high oxygen content, one should be a coking and the other a non-coking coal. The reason I advance is that in the one the high oxygen content is due to humus bodies, which will not coke owing to the low pitch-forming nature of the hydrocarbons, while with the other the oxygen is due to resin bodies which are essential to good coking.

Other Confirmatory Authorities

In 1898 Anderson and Roberts,[1] as the result of a long research upon the chemical properties of Scotch coals, came to the conclusion that a considerable part of the organic matter in coal consists of a complex compound comparatively rich in nitrogen and also containing sulphur. They also held that there is resinous material present, and that the remaining constituents are composed of degradation products of the original carbo-hydrates of the coal plants. This theory in its essentials agrees very well with my views on the subject.

During the present year Burgess and Wheeler[2] have published the results of a series of experiments upon the distillation of coals at various temperatures, which lead them to conclude that coal contains two types of compounds of different degrees of ease of decomposition.

The most unstable type decomposes below 1382 deg. F., and yields on distillation the paraffin hydrocarbons and no hydrogen: the other decomposes only at or above 1382 deg. F., and yields hydrogen only, or possibly hydrogen and oxides of carbon.

The latter they suppose to be a degradation product of cellulose; the former to be derived from the resins and gums from the coal plants, and the authors consider that the difference between one coal and another is determined by the proportion in which these two types exist in the coal.

The Manufacture of Coalite

In 1907, while working on the "Coalite" process, I found that the possibility of making this smokeless fuel was dependent upon the fact that if the coal was distilled at temperatures ranging from 752 to 932 deg. F., all the liquid and all the heavy hydrocarbon products of its decomposition capable of forming smoke were evolved. The volume of gas produced varied from 4000 to 5000 cu.ft.

The coke still contained a residual compound which required a temperature of from 1292 to 1832 deg. F. to decompose it. At these temperatures a volume

*Royal Naval College, Greenwich, Eng. Note—A part of a series of lectures on "Carbonization of Coal," delivered before the Royal Society of Arts.

[1]Jour. Soc. Chem. Ind., 1898, 1019.
[2]Chem. Soc. Jour., 1911, 649

of gas nearly equal to the original yield was evolved, consisting of hydrogen and methane with small quantities of oxides of carbon.

It was this volatile compound which gave the coalite its ease of ignition and flaming combustion.

This I stated in a Cantor Lecture at the Royal Society of Arts in 1908, when giving the principle of the manufacture of coalite, as follows—"Success can be achieved only by dropping the temperature to a scarcely visible heat, and when this is done the coke may be kept at it for almost any period without driving out these volatile hydrocarbons which give easy ignition and a smokeless flame."

Methane is Evolved to the End

It is evident that this more resistant volatile residue is the body which Burgess and Wheeler consider a degradation product of cellulose, which on heating "yields hydrogen alone."

The error into which these observers have fallen in supposing that hydrogen alone is evolved is due to the fact that their assumptions have been based upon the composition of the gases evolved during distillation at successive stages of temperature and the use of very small quantities of material.

Had Messrs. Burgess and Wheeler used a larger quantity of coal and distilled out everything which would be driven out up to 1112 deg. F., and had then distilled the residue between 1472 and 1652 deg. F., they would have found that at these temperatures the residues were still yielding a certain proportion of methane.

Do Any of the Primary Compounds Endure 1292 Deg. Fahrenheit?

Another great mistake made by Burgess and Wheeler lies in supposing that of the two classes of compounds present in coal one decomposes below 1382 deg. F., while the other decomposes only at or above that temperature and yields hydrogen only.

All the evidence that can be adduced shows that when a coal undergoes destructive distillation all the hydrocarbons, together with the resin and humus constituents, undergo decomposition at a temperature certainly well below 1292 deg. F., and that as the liquid and gaseous products distil out they leave behind their less volatile residues as a pitch.

This lutes together the carbon particles and forms soft coke. As the temperature rises above 1382 deg. F., the pitch residue decomposes, yielding hydrogen, carbon monoxide and methane as gases. The carbon residue from the pitch binds the residual mass into coke, and it is this pitch that Burgess and Wheeler have mistaken for a primary constituent of coal.

[3]Journal of Gas Lighting, 1908, I, 825.

The Smoke Problem

In the fall of 1911, the department of industrial research of the University of Pittsburgh, was provided with funds for a thorough investigation of the smoke nuisance. At the present time, the inquiry is being conducted by a corps of 25 specialists, of whom seven are giving their entire attention to the work. The following article is abstracted from "Science" and was written by R. C. Benner, who is chemist for this investigation:

"No group of men has hitherto made a coördinated effort to undertake a complete scientific study of the problem of smoke prevention. One of the public-spirited citizens of Pittsburgh, recognizing this fact, has established a fellowship of $12,000 per year in the Department of Industrial Research of the University of Pittsburgh for the scientific investigation of this problem.

"We have an unpretentious laboratory, designated as a "smoke house," a small fireproof building, 18 ft. wide and 30 ft. long, which is situated at a sufficient distance from the main laboratory, so that the smoke can be made in quantities as large as we may need in our work and yet under such control that it will not interfere with the other researches which are being made.

"In this building, there is a furnace so constructed that it is possible, by varying the conditions, to produce any kind of coal smoke. This statement may perhaps appear strange to those who have always considered the product of the incomplete combustion of coal as "just smoke," but our studies of this material reveal new properties continually. There are differences in the physical state, as well as in the amounts of tar, carbon, ash, etc., in smoke made from different kinds of coal under different conditions of temperature, etc.

"By means of fans and motors the smoke can be conducted to various parts of the building, where it can be used for experimental purposes in any manner desired. It is here that the physical and chemical studies are being conducted, with the object of learning more definitely just what are the various properties of soft-coal smoke, and of endeavoring to ascertain new properties which will be of aid in the abolition of the smoke itself.

Means of Observing Smoke from Boiler House

"It is a well known fact that it is possible to prevent the formation of smoke with an accompanying economy of fuel, and that there are many forms of furnaces constructed which can be operated with ideal results. The obtaining of men sufficiently intelligent for their proper operation is, however, a problem difficult of solution, for the wages are small and employment far from pleasant.

"One of the chief aims of our experimental work is, then, to find a means of making the man in the boiler room perform his duty in the best possible manner. A mechanism is being devised, which is simple, practical and 'fool-proof,' which will warn the stoker in the boiler room, automatically, that the smoke his fire is making is in excess of that permitted by law.

"Inquiry is being instituted, in the most accurate manner possible, into the true increase in the cost of living, which is due to the damage done by smoke to the property of the residents of this smoky district. Special stress will be laid upon this portion of the investigation, because of the fact that while those who have made Pittsburgh smoky, may be large losers by the neglect, they are in all possibility not the greatest sufferers from their negligence. Among the list of those upon which the burden falls we may include dwellings, hotels, hospitals, picture galleries, museums, office buildings, banks, libraries and stores, both wholesale and retail.

Relation of Consumption, Nasal Catarrh and Stomach Trouble to Smoke

"The relation of smoke to the health of the residents of a smoky district is one worthy of careful consideration, and we hope to be able to put it on a more scientific basis than that on which it now stands. It is a well known fact that the lungs of a person dwelling in a smoky atmosphere become coated with soot particles. Does this make him more susceptible to consumption? The question has been answered both negatively and positively by different authorities. From a thorough examination it would appear that Pittsburgh did not have as much consumption as other cities similarly located, where there is much less smoke.

"There is more consumption in those portions of the corporate limits of Pittsburgh occupied by the better residences and where there is less smoke and dirt than there is in the more congested districts where smoke abounds. On the other hand, catarrh and other nasal diseases are prevalent, due to the irritation caused by the smoke particles. Furthermore, it has been very often said that stomach trouble is indirectly caused by smoke because those who suffer from the diseases it fosters swallow much of the mucus their membranes create. Nor are the eyes immune; eye specialists say that their busiest time is after a heavy fog which is accompanied by smoke.

Influence of Smoke on Vegetation

"From the side of aesthetics and the city beautiful, we must take up the effect of coal smoke on buildings and on plants. The botanical side of the question is one of special scientific interest, for while the relation of plants to smelter fumes, etc., has received considerable at-

tention, little if anything seems to have been accomplished, or even attempted, to discover what is the effect of carbon, tar and phenol, and other compounds of a similar nature which are found in smoke. It may be of interest to state in this connection that I have found as much as 44 per cent. of tar in samples of soot examined. Knowing this, it can well be understood that carbon smoke might have a very injurious effect on vegetation, more especially in spring, when the new leaves are appearing, and plants being tender are much more readily affected by the toxic action of the soot and accompanying substances.

RELATION OF SMOKE TO FOG, MIST AND HAZE

"The meteorological aspect of the smoke problem is being considered. This part of the investigation will, for the greater part, consist of the application to our local conditions of the methods used in other places. The smoke problem is not an easy one to handle. There are many obstacles to overcome and many prejudices to set right. Without power to act, knowledge in itself would be of little avail. Therefore, the legal aspect of the situation will form no small part of our investigation.

"In brief, then, we have in this research the twofold object of scientifically ascertaining the true economic status of the smoke problem in all its phases, and the devising of ways and means of making the smokeless combustion of soft coal the rule rather than the exception."

The Coal Trade of Leipzig

BY R. H. COULSON

In his report for the year 1910, Viceconsul Turner states that the mines in the district of Leipzig are principally around Zwickau, Oelsnitz and Dresden, with a scattering of brown-coal mines around Dresden and Leipzig.

The output of coal for the home market in Germany increased about 2,000,000 tons, while the increase in the export trade amounted to about 1,000,000 tons. This makes the net increase in Germany's coal production for 1910 about 3,000,000 tons.

In 1910 the import trade in coal amounted to 11,000,000 tons, which was 1,000,000 tons less than that of the previous year.

Furthermore, an increase of 1,000,000 tons was recorded in the brown-coal industry over the figures for 1910. The net production for the year was 69,000,000 tons. The import trade, on the other hand, suffered a 750,000-ton slump. It is worthy of note that Austria-Hungary is the principal factor in Germany's brown-coal import trade. Moreover, the vice-consul observes that lignite is rapidly replacing coal as a fuel.

Consul-general Sir Francis Opheimer, in his report, observes that there is a remarkable increase in the amount of coal imported into Germany within recent years. He attributes it to the peculiar methods prevailing in the German market. Many circumstances have led customers to seek freedom from the dictatorship of the syndicate which seems to exist, by purchasing English coal which enjoys the advantage of cheap transit by water.

Among these circumstances can be mentioned the progressive concentration of German coal production in a few concerns, the difficulties placed in the way of unfettered trade, the almost unavoidable necessity for making use of the syndicate's selling bureau and a price policy which prevents judicious purchases at favorable opportunities.

According to Sir Francis, the price policy of the syndicate aids materially the sale of British coal, and, as long as it lasts, the hold of British coal on the German market is not likely to be weakened by any lowering of freight charges on railroads in Germany. He further adds that the advisability of an import duty on coal may safely be left to the German consumers, who fully realize that, if they were deprived of the opportunity to obtain British coal, they would be at the mercy of the syndicate.

Preparation of Anthracite Coal

SPECIAL CORRESPONDENCE

The preparation of anthracite coal, as it is popular known, consists in the crushing of the large pieces to commercial sizes, separating the various sizes by the use of shaking and cylindrical screens and removing the impurities, slate, bone, rock, etc., by the use of jigs, friction, gravity or centrifugal pickers.

For years the first stage of the preparation has been made secondary to sizing, cleaning and production. It has been of late years, only, that the various mining interests have given the preparation of coal the attention it deserves. In order to minimize the waste loss in breakage they have employed the best mechanics and talent obtainable, who have studied this from a scientific point of view, keeping data showing results in the use of various rolls, screens, jigs, conveyor machines, etc., upon the increased sizing of coal.

Heretofore one style of roll has been used, composed of two cylindrical bodies, whose surfaces are fitted with teeth and revolve towards each other.

It is obvious that a great deal depends not only on the size and shape of these teeth, but on the speed. Possibly from the earliest history of the anthracite mines the peripheral speed of these rolls or teeth was considered by mining men to give the best results when approximating 1000 ft. per min.

This was figured from the speed of a falling body due to gravitation, which is approximately 16 ft. per sec., after the first second. The theory is that the coal falling from a chute above the rolls enters directly between the rolls and is crushed or cleaved on its passage without striking. The sudden stop, and the resulting breakage the coal receives in striking the chute immediately under the roll, however, was lost sight of.

It remained for William Lloyd, superintended of the Lehigh Valley Coal Co.'s machine shops, to depart from this old-time theory, and the Lloyd compound-gear driven rolls are successful to a large extent in solving the difficulties encountered. The design is based on results of careful tests and experiments with various speeds, shapes of teeth, etc.

In the first place, the peripheral speed is reduced to 300 ft. per min. The roll body is one solid casting, machined and fluted longitudinally to receive the segments, which are all interchangeable and are fitted into the several recesses, so that, when all put together, it is a rigid and fool-proof construction.

The bolts holding the segments in place are subject to no strain excepting that of centrifugal force.

This design of roll can be used for all sizes of coal, by merely changing the segements. These can be ordered separately and applied for any purpose or sizes required in the preparation of coal.

The cog wheels on the roll shaft are made with removable rims. The heavily reinforced hub is keyed on the shaft to stay, thereby avoiding the delays so numerous with the solid type of cog wheels, due to the breaking of teeth and the consequent shut-down necessary to replace with a new one.

Furthermore, the compound-geared rolls preclude the possibility of delay through stalling, since ample power is used to take through any coal or other material going with it. Provision is made for sulphur balls and hard rock, however, by using one compensating set of pedestals equipped with long tension springs.

These rolls have been tried for efficiency, breakage, and prepared sizes. They have "made good," some of the tests giving as high as 91 per cent. prepared sizes and as low as ½ per cent. of dirt.

The original first-aid corps in America was that organized in 1899, by Dr. M. J. Shields, at the Jermyn colliery of the Delaware & Hudson Coal Co. These have now spread to such an extent that nearly all anthracite collieries are equipped with well drilled corps. They have promoted unity of action among all classes of mine employees, as well as effected a reduction in the mortality percentage at the mines.

Discussion by Readers

Comment, Criticism and Debate upon Previous Articles, and Letters from Practical Men

Booster and Tandem Fans

I have read with much interest the different letters in the recent discussion of "Booster and Tandem Fans," and wish to offer the following as my personal opinion regarding booster fans and fans running in tandem:

The booster fan, in my opinion, can be used to great advantage under certain conditions, and be made to assist the ventilation of certain districts, in a mine where the air current through friction and leakage has become weak and sluggish. At the present time, I am using this system in our mine, though as yet it has not advanced beyond the development stage.

We had installed a 35-in. Buffalo reversible blower to be operated as an exhaust fan for the ventilation of the main rock tunnel. This tunnel had been driven a distance of 2150 ft., to a point where we were to start a circular upraise through the rock. This upraise was to be 8 ft. in diameter and driven on a pitch of 45 deg. for a distance of 512 ft. to the surface. It was to be used as a permanent air shaft and second opening for the mine, the intention being to place the permanent fan over this air shaft.

Realizing that the outside fan had almost reached its capacity or limit of usefulness at the point where the upraise was to be started, we installed a 45-in. Buffalo blower on the surface, at the mouth of the tunnel, and took the 35-in. blower into the mine to a point 50 ft. outside of the upraise or air shaft. The results obtained have been gratifying indeed. The 45-in. blower discharges its air through a 12-in. galvanized pipe, which conducts the air to the orifice or intake of the 35-in. blower, to which the end of the pipe is connected. The latter discharges its air through a 12-in. pipe to the face of the upraise, where it escapes into the heading and returns to the mouth of the mine. The galvanized pipe practically takes the place of an air course.

The mine is being driven by two 3½-in. compressed-air drills of the Wood type; and, although the blasting is very heavy, the face of the upraise is cleared of all smoke and fumes, in a few minutes after a round of shots is fired.

Making the Test

I speeded up the outside blowing fan to 800 r.p.m., which was about half-speed, and obtained the following quantities of air, at different points in the airway where the pipe was temporarily disconnected to enable one to get a reading. The speed of the fan was kept constant, during all the tests. In each case, the air was measured at the point where the pipe was disconnected; but the water-gage reading was taken at the fan drift, a short distance from the fan.

Test No. 1—The air pipe was disconnected at a point 500 ft. from the mouth of the tunnel, where the outside fan was located, and the reading taken showed an air volume of 2986 cu.ft. per min., and a water gage of 3.3 in.

Test No. 2—The air pipe, in this test, was disconnected at a point 1000 ft. from the mouth of the tunnel and the reading showed an air volume of 2049 cu.ft. per min. and a water gage of 3.8 in.

Test No. 3—This test was taken at the point where the pipe enters the booster fan, the pipe being disconnected at this point. The reading showed an air volume of only 550 cu.ft. per min., and a water gage of 4.1 in.

All the water-gage readings for these three tests were taken, outside, on the fan drift, a short distance from the fan. The tests showed that this fan had practically reached the limit of its usefulness at the point, 2150 ft. from the mouth of the tunnel. It was here that the booster was installed. I now connected the air pipe to the booster fan so that it would pick up the air coming from the outside fan, which was still run at half-speed.

Test No. 4—In this test, the air pipe was disconnected at a point about 20 ft. beyond the booster fan. The booster fan was started and speeded up until it caught the air. The reading of the anemometer, at the point where the pipe was disconnected, 20 ft. beyond this fan, showed an air volume of 1885 cu.ft. per min. A water gage placed on the air pipe where it entered the booster fan showed a depression in the pipe, at this point, of 1.1 in.

This, in my opinion, demonstrates actually what a booster fan will do when installed in a mine where the air current has become weak and sluggish through friction of air courses and leakage. I might state that the joints of the air pipe were all wrapped with tarred canvas so that the leakage would be reduced to a minimum; and not be any greater than might be expected through well constructed stoppings between the intake and return airways, as very few stoppings are absolutely air-tight.

The increased quantity of air, as recorded above, when the booster fan was started, was due to two causes: First, the depression caused at the intake to the booster assisted the outside fan, as it decreased the pressure against which that fan operated before the booster was installed. Second, this depression in the pipe reduced any leakages that might otherwise occur in the air pipe, within a certain radius of depression created by the booster.

It will, also, be noted that when the outside fan was working alone the quantity of air decreased and the pressure increased as the length of the air pipe was increased. This conforms to the laws of ventilation.

Regarding two fans running in tandem, I wish to say that, while I do not consider it good practice to install fans in this way, yet I believe the ventilation of a mine can often be improved by a second fan installed at a point where, as I have stated, the current has become weak or sluggish. In pitching seams such as we have here in the Northwest where the coal seams are thick, the roof often caves and large cracks or fissures frequently appear on the surface, owing to the subsidence of the strata over that portion of the mine where the coal has been extracted. The quantity of air leaking through these cracks increases as the mine is extended, owing both to the larger number of fissures and the increased water gage required to maintain the circulation. As a consequence, when the main entries have been driven a distance of, say 10,000 or 12,000 ft., the air current commences to get weak and sluggish. I wish to say that it is right at this point a booster fan, in my estimation, would demonstrate its utility and effectiveness, as by the depression it causes, it is able to counteract, to a great extent, the leakage of air to the surface, besides greatly assisting the outside, blowing fan which then discharges into a partial vacuum instead of against the back pressure, as would be the case if the exhaust fan were not running and the air was discharged directly into the atmosphere. In my opinion, the same assistance is given to a blowing fan that would be given to a steam engine exhausting into a condenser or a partial vacuum instead of exhausting against the atmosphere.

J. W. Powell,
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Columbia Coal & Coke Co.
Coalmont, B. C., Canada.

Central Station Power

I was much interested in the paper by Graham Bright on "Central Station Power for Coal Mines," which you reprinted in your issue of June 8, more particularly as this proposition recently came up at one of the plants with which I am connected.

After reading the article through very carefully I fail to see what becomes of the $17,460 worth of plant which Mr. Bright so unceremoniously ditches. If the plant he has assumed is supposed to be completely written off the books of the company no allowance for paying interest on this investment would be necessary; but as he allows, in his table, interest on the full cost of the plant it must be assumed that it is comparatively new, in which case in purchasing power from a central station it would be necessary that the cost be sufficiently low to pay interest and depreciation on the original investment as well as the new money that is put into it. He has not even allowed for interest and depreciation on the salvage which he gets out of the old plant and promptly reinvests. Figuring in this manner the saving of purchased power would be $0.0146, instead of $0.0178—making the difference between the total cost of power and the saving $0.0084, or the common cost per kw.-hr. which will exist in either case, and making the total cost per kw.-hr. with purchase power exclusive of central-station charge $0.0098, instead of $0.0066—and the annual saving only $420, or 6¼% on the net investment. It is almost too low to warrant the change.

Going back over the items of his present cost I find 500 tons of coal assumed as producing 50,640 kw.-hr., or approximately 22½ per kw.-hr. This figure would be cut in half and still be operated as far from economical plant. With this change in the operating cost it would appear that the mine power plant were the cheaper of the two and that it would not be necessary to reinvest an additional amount for new equipment which might be more profitably expended developing the mine.

In this connection I think it only fair to state that the cost of central-station power should be credited with the difference between the cost of mining of coal normally used in the mine plant and the figure at which it is usually sold, as this represents money coming in which was not previously realized.

I do not mean to appear to be against central-station service, but I think it wise for operators considering a change from their present equipment to that of central-station service, to figure out their own cases very carefully before making any decision.

One of the great disadvantages in central-station service is the possibility of an interruption of service by the breakage of transmission lines at some remote point. The mine plant is close to the workings and as it has but a short line to maintain, breakages are rapidly repaired, and in any event if one of the units in the plant fail the mine at least can operate to a part of its capacity with another unit.

In purchasing power from a central station I would recommend the protection of the operator by a clause rendering the power company liable for the profits of a day's run as shown by the tipple or railroad scales of the previous week, should the power fail to be on by the time when the usual contract miners are at work, for although the power may be turned on two hours after normal operations commence all contract miners will have returned to their homes and a day's output be lost. The clause to apply only to interruptions due to transmission, as accidents due to fire, strikes, etc., may occur to the local power station.

SHELDON SMILLIE, E. M.

Sealing Off a Mine Fire

In looking over some back numbers of COAL AGE, just received, I was much interested in the discussion of mine fires, and the question as to whether the first stopping should be built on the intake or on the return end of the fire.

I note that about 30 different men, nearly all of whom hold responsible positions in mining work and have had experience in fighting mine fires, wrote letters on the subject, in which they expressed decided opinions as to the proper place for the first stopping. All but one so far as I remember, used theoretical arguments or none at all to prove their contention, and some were convinced that one way was right, and others of probably equal ability were convinced that the other way was right.

One man cited only two cases where explosions had resulted when he built the first stopping on the intake side, while he had built many stoppings on the return side of mine fires without causing explosions. It appears to me that the theories advanced show a surprisingly shallow consideration of the subject.

I propose to attempt a more detailed analysis of the forces acting under various conditions in order to determine as nearly as may be done theoretically from the data available just what the resulting phenomena will be and so determine on which side the first stopping should be built. There were published in COAL AGE, Dec. 23, p. 348, some gas analyses made by G. A. Burrell, chemist of the Federal Testing Station, at Pittsburgh, Penn. The gases analyzed were taken from an area in which a mine fire had been sealed off some time and should throw some light on the subject of fighting fires. I will call attention to some of the significant facts in these analyses. Two samples of gas taken from an inclosed area, in a bituminous mine, in which a fire had been sealed up nine months showed the oxygen reduced to 0.30 per cent. Two samples taken from another bituminous mine, in which fires had been sealed up only 4 and 7 hours, showed the oxygen reduced to 1.69 and 1.83 per cent., respectively. In the cases mentioned, the CH_4 ranged from 3.39 to 5.37 per cent.

Samples taken from an anthracite mine that had been sealed up showed the oxygen reduced to 8.3 per cent., at one time, with 1.3 per cent. CO and 11.5 per cent. CH_4; yet the fire continued burning, as was shown when two days later, by the inleaking of air the oxygen rose to 14.1 per cent., and the fire burst forth with renewed vigor. These facts seem to indicate that for any effective smothering action to be produced, the oxygen must be reduced more than one-third; while a fire may continue to burn slowly when the oxygen has been reduced to a very small percentage.

This is a subject on which more information is badly needed, but it is useless to expect to get it by asking the opinions of experienced men. Most of the experienced men who discussed it probably started out with some prejudiced ideas as to the proper method to employ. They have used that plan in every case with which they have had to deal and in most cases, perhaps have gotten fairly satisfactory results, but if an explosion did occur they would think it was one of those cases that could not be helped and so each would be convinced that his method was right.

I think the mining journals can do a real service in collecting such data and placing it on record. If mining men who have known of fires that have caused explosions while being sealed off will put those on record, in the pages of COAL AGE, or some other mining journal, giving a description of all the conditions affecting the case, we can have the benefit of their experience and some one of an analytical turn of mind may then be able to correlate the facts and develop reliable rules for guidance in the future.

In conclusion, I will say, in my opinion, the safest way will be to either build both stoppings simultaneously, or if this is impracticable, build one stopping part way and then build the other; so as to have the last stopping finished very quickly after the direct circulation is stopped and in the meantime keep a sufficient amount of air passing the fire even if necessary to change the regular circulation somewhat to do this.

LEONARD L. QUISENBERRY,
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Examination Questions

Selected from State Examinations, or Suggested by Correspondents

Examination Questions

Ventilation

Ques.—Explain the meaning of the formula, $R = pa = ksv^2$?

Ans.—This formula expresses the resistance offered by a mine or airway to the passage of the ventilating current. It is the resistance that causes the ventilating pressure. The total resistance is equal to the unit pressure p (lb. per sq.ft.) multiplied by the sectional area of the airway a (sq.ft.). The mine resistance is also found by multiplying the unit resistance (k) by the number of square feet of rubbing surface (s), and that product by the square of the velocity (v^2) of the air current, expressed in feet per minute.

For example, an air current traveling with a velocity of 600 ft. per min., in a mine having a rubbing surface of 60,000 sq.ft., will produce a resistance or total ventilating pressure of

$$R = 0.00000002 \times 60{,}000 \times 600^2 = 432 \text{ lb.}$$

Ques.—What pressure and water gage will be required to pass 60,000 cu.ft. of air per minute through an airway 8x10 ft. 4000 ft. long?

Ans.—The rubbing surface of this airway is $2(8 + 10) \times 4000 = 144{,}000$ sq.ft. The area of the airway is $8 \times 10 = 80$ sq.ft., and the velocity of the air current $60{,}000 \div 80 = 750$ ft. per min. The unit pressure is, therefore,

$$p = \frac{ksv^2}{a}$$

$$p = \frac{0.00000002 \times 144{,}000 \times 750^2}{80}$$

$$= 20.25 \text{ lb. per sq.ft.}$$

The water gage corresponding to this pressure is

$$w.g. = \frac{20.25}{5.2} = 3.9 \text{ in., nearly}$$

Ques.—What horsepower will be required to produce the circulation, in the last example?

Ans.—The horsepower on the air, required to circulate 60,000 cu.ft. of air under a pressure of 20.25 lb. per sq.ft., is

$$H = \frac{Qh}{33{,}000} = \frac{60{,}000 \times 20.25}{33{,}000} = 36.82 \text{ hp.}$$

Ques.—Assuming the combined efficiency of the ventilating fan and engine is 60 per cent., what must be the indicated horsepower of the engine driving the fan, in the last question?

Ans.—The indicated horsepower of the engine is

$$36.82 \div 0.60 = 61.37 \text{ i.hp.}$$

Water-gage Calculation

Ques.—Explain and show the derivation of the constant, 5.2, used in finding the water gage corresponding to a given unit pressure.

Ans.—The weight of 1 cu.ft. of water is, approximately, 62.5 lb. The weight of a layer of water 1 in. deep and 1 sq.ft. base is, therefore, $62.5 \div 12 = 5.2$. This is the pressure, in pounds per square foot, due to 1 in. of water column. Therefore, to find the water gage, in inches, corresponding to any unit pressure (lb. per sq.ft.), divide the given unit pressure by 5.2; and the quotient will be the inches of water gage. In like manner, to find the unit pressure corresponding to any water gage, multiply the water gage, in inches, by 5.2, and the product will be the pressure in pounds per square foot.

Mine Regulators

Ques.—What is a regulator, in mine ventilation; and for what purpose is it used in the mine?

Ans.—A regulator is any contrivance that, when adjusted in an airway, will divide the air proportionately between two splits or airways that are ventilated by the same means. There are two forms or styles of regulator. The most common form is that known as the "box regulator," which is a simple brattice or partition built in the airway and provided with an opening whose size can be regulated by a movable shutter. The regulator obstructs the flow of the air, in the airway in which it is placed, thereby forcing a larger quantity of air to pass through the other airway.

A less common form of regulator consists of a door hung at the mouth of the splits and so arranged, with its head swung into the wind, that, by moving the door to one side or the other, the air will be divided in any desired proportion between the two airways. The same effect is produced, in dividing the air current, by moving the shutter of the box regulator until the desired proportion of air is obtained.

Ques.—Does a regulator increase the friction of the air circulating through a mine?

Ans.—The box regulator has the same effect on the circulation as increasing the length of the airway would have. In this style of regulator, the resisting power of that airway having a less natural resistance, is increased, which causes it to pass less air. The ventilating pressure is increased and, the power remaining constant, the total quantity of air circulated is reduced, owing to the resistance of the regulator.

Ques.—How is the resistance of a regulator calculated?

Ans.—The resistance of a box regulator is calculated by subtracting the natural resistance of the split in which the regulator is placed, from the natural resistance of the free or open split. The difference between these two resistances is due to the regulator.

Motive Columns

Ques.—Explain the meaning of the term "motive column."

Ans.—This term, as used in mine ventilation, describes an imaginary column of air, 1 sq.ft. in section, of such height that its weight will produce a certain given pressure, in pounds per square foot. The motive column corresponding to any given pressure (lb. per sq.ft.) is found by dividing the unit pressure by the weight of 1 cu.ft. of air.

Ques.—Find the motive column corresponding to a pressure of 13 lb. per sq.ft.; (*a*) in terms of the upcast air; and (b) in terms of the downcast air. The average temperature of the upcast shaft is, say, 150 deg. F., and the average temperature of the downcast shaft is 40 deg. F.

Ans.—It is necessary, first, to find the weight of 1 cu.ft. of the upcast and the downcast air, respectively, assuming a barometric pressure of 30 in. For example, the weight of 1 cu.ft. of upcast air is

$$w = \frac{1.3273 \times 30}{460 + 150} = 0.06527 \text{ lb.}$$

The weight of 1 cu.ft. of downcast air is

$$w = \frac{1.3273 \times 30}{460 + 40} = 0.079638 \text{ lb.}$$

(*a*) The air column, in terms of the *upcast* air, corresponding to a pressure of 13 lb. per sq.ft., is then

$$\frac{13}{0.06527} = 199.2 \text{ ft.}$$

(*b*) The air column corresponding to the same ventilating pressure, in terms of the *downcast* air, is

$$\frac{13}{0.079638} = 163.2 \text{ ft.}$$

Sociological Department

For the Betterment of Living Conditions in Mining Communities

Coal Dust as a Corrective for Tuberculosis

By Jonathan M. Wainwright* and H. A. Nichols†

We have tried to add some experimental evidence which would exhibit the influence of anthracosis[1] on tubercular disease of the lungs and as far as we have gone our experiments have proved the physiologic relation of the two conditions. Our method has been to keep guinea-pigs for about two months in a box in which coal dust is constantly kept in motion. In this way quite a degree of anthracosis has been produced.

We have then taken these pigs and injected a suspension of a pure culture of tubercle bacilli directly into the trachea which was exposed by dissection. In this way one can be quite sure that the tubercle bacilli actually reach the lungs. Control animals which had not been subjected to the dust were also injected in the same way with the same syringe full of suspended bacilli so that as far as possible the same dose was obtained for all.

No Tubercles on the Pig's Lungs

In the first series, when the pigs were killed, the control had extensive tuberculosis of the lungs and abdominal viscera. The anthracotic pig had extensive tuberculosis of the abdominal viscera and of the glands around the tracheal injection, but the lungs were free.

In the second series the result was the same. Two anthracotic pigs were given an injection of tubercle bacilli and the lungs of both were free of tubercules. In the third series the two anthracotic pigs had pulmonary tubercles, and practically the post-mortem finding did not differ from that of the controls of this series. If, therefore, half of the pigs were protected from pulmonary tuberculosis by the coal dust, it creates a strong argument that anthracosis resists tubercular infection.

We should not, of course presume that every pig would be fully protected by the coating of its lungs with coal dust. The animals thus far tested are too few to give a completely conclusive result, but a great deal of time will be required to get more data. Each experimental series takes about four months to complete and many have failed, so that much time has been lost. These experiments are being continued.

Coal Dust Confers a Degree of Immunity to Other Organs

We have also obtained a similar result by injecting a suspension of coal dust into the testicles of guinea pigs and later injecting the same organs with a suspension of tubercle bacilli. Pigs which had previously been injected with coal dust lived on an average 49 days, but the mean life of the controls was 25 days.

Having gone as far as is now possible in demonstrating that those who have anthracotic lungs are less susceptible to tuberculosis the cause of this phenomenon must be considered. The theory most frequently mentioned is that it is due to the germicidal action of the coal dust.

We have tested this alleged property of powdered coal by various methods on tubercle and typhoid bacilli, staphylococcus, vibrio, and several unidentified bacteria, and have found that the dust has no germicidal action whatever.

It is true that if bacteria are mixed with sterile dust and allowed to remain in contact with it in a test tube for several days and then plated a slight inhibitory influence will be observed, but even this prolonged close contact will not kill bacteria. There are also several *a priori* reasons against this germicidal action of the dust.

Dr. Nichols considers that it is possible that the soluble calcium salts which form a large proportion of the ash of coal dust may at least play a part in the protective influence. He is now working on his theory.

Germless Character of Mine Air

Another idea has been that the rarity of tuberculosis among miners is not due to any protective influence but depends on the fact that the air of mines is comparatively free from bacteria. We have shown by tests that the air of mine chambers is less germ-laden than outside air. The air supplied to these, passes slowly through damp gangways sometimes a half mile long.

During this passage many bacteria fall to the ground, so that the air when supplied to the chambers has undergone cleansing by sedimentation such as takes place in rivers. Our tests were by the ordinary Petri-dish method. The dishes were exposed at the beginning of the intake or air tunnel and again for the same length of time in various chambers. Table I shows two characteristic examples of results.

TABLE I. PURIFICATION OF AIR BY PASSAGE THROUGH MINES

Where measured	Number of colonies on dish in three minutes	
	Diamond Mine	Dodge Mine
Beginning of intake.....	880	390
Average in chambers.....	54	18
End of return tunnel.....	15	...

This bacterial purification of the air in which the miners work, together with the fact noted in the previous paper, that the sputa cannot dry, must have some effect in diminishing tuberculosis.

As we have said, however, it is probably not the sole factor. Our own opinion is that the coal dust in the lungs does exert a real protective influence against the tubercle bacilli, and that the reduced mortality from tuberculosis is due to the stimulating effect of the coal dust on the growth of connective tissue. This growth is, of course, the way in which nature overcomes the tubercle bacilli.

Anything stimulating nature will be a valuable aid in preventing them from getting a foothold or in overcoming them when once established. That the coal dust causes the stimulation of connective tissue growth is well known.

Stages of Anthracosis

Microscopically, anthracosis may be divided into three stages: The first is seen in those who have worked in the mines only a few months. In some of these the epithelial cells lining the alveolæ can be seen to be swollen and to contain coal dust. Sometimes a few larger desquamated cells containing much pigment can be found in the alveolæ, lying loose with

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Note—Third and concluding part of a paper read before the Laennec Medical Society, at Baltimore, entitled "The Relation between Anthracosis and Pulmonary Tuberculosis." Previous articles were published in the Sociological Department of Aug. 3 and 24.

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[1] In response to a letter of inquiry, Dr. Wainwright says anthracosis "really means a deposit of coal dust on the lung. This is a condition, of course, present to a certain extent in all people who live in dusty cities, but is much more prevalent in mine workers as, of course, they are inhaling the dust most of the time.

"The term itself simply applies to the deposit on the lung and is equally applicable whether it gives any symptoms or not. When these appear, however, the anthracotic subject has mainly a cough or shortness of breath with more or less impaired health. This clinical condition is what is commonly spoken of as miners' asthma."

some detritus and free dust particles. Even in the early stage dust particles can be seen in the walls of the air vesicles and around the bronchi. In this stage there is no thickening.

The second stage occurs in those who have worked in the mines for several years. In these cases the swollen epithelial cells containing dust particles are much more numerous. The alveolæ contain more detritus consisting of swollen dust-bearing epithelial cells, and free dust, and some leukocytes. The pigment in the walls of the air vesicles is more marked.

It collects particularly in the connective tissue septa between the lobules where it is in such large masses as to be easily seen by the naked eye in microscopic sections. These are especially well seen in the septa that run in from the pleura and one will frequently see black triangles of considerable size with their bases on the pleura showing where some septum has been completely filled up with dust.

With this deposit there goes an increase in the connective tissue of the alveolar septa wherever there is much dust. The interlobular septa thicken as does also the peribronchial connective tissue, as here also the dust tends especially to collect. With this stage the bronchial and mediastinal lymph glands are enlarged and perfectly black.

The glands also in the lesser omentum are frequently blackened by dust swallowed in the saliva. The increase of connective tissue is rarely sufficient to give signs of consolidation. With this stage sometimes comes the condition misnamed "miner's asthma." This is really a chronic bronchitis and emphysema both in symptoms and physical signs.

A third interesting picture is seen in those who have formerly been miners for many years, but who have not been in the mines for some years before death. In these the signs of irritation and swelling have subsided in the epithelium and it is again normal and neither the cells nor the alveolæ contain dust. The deposits of dust in the alveolar walls, the septa, and the peribronchial tissue still remain and there is the same thickening of the connective tissue.

"Miner's Asthma"

The histological picture of epithelial irritation and thickening of the connective tissue with consequent loss of elasticity of the air vessels easily accounts for the condition inaccurately termed "miner's asthma." This is clinically a chronic bronchitis and emphysema. We had formerly considered that the simple anthracosis could never give rise to physical signs of consolidation.

Quite recently, however, we have seen an old miner who had distinct signs of consolidation down to the fourth rib on the right side. There had been no history of acute inflammation nor of tuberculosis. Repeated sputum examinations and the tuberculin test were negative and we were forced to conclude that the signs of consolidation were due to anthracosis.

In some fifteen autopsies on miners, we have never seen any diffused consolidation. Only once have we made out tuberculosis scars at the apices, though these can easily be concealed in the blackened lung. "Miner's phthisis," which is an unfortunate term used in England, is undoubtedly a misnomer as far as the phthisis goes. Real tuberculosis lesions in miners are always due to the tubercle bacillus.

It may be of interest to note in passing, merely as a matter of record, that we have made a number of analyses of miners' lungs and those of people who are not anthracotic. By the most careful methods we could employ we found that there was a considerable margin of error. In a rough way we can say that the foreign matter in the lungs of old miners is about 33 per cent. of the dried lung. In adults who have not been especially subject to dust, it runs from 1 to 3 per cent. or a little over.

Dust in Anthracite Mines

The quantitative estimation of the dust in mines may also be of interest. This quantity naturally varies with many conditions.

TABLE II. DUST INTENSITY IN VARIOUS PLACES

Point of Observation	Observer	Grams per cu. meter	Lb. per million cu. ft. [3]
City after rain	Tissandier	0.00025	0.0156
Iron Foundry	Arens	0.0015 to 0.0280	0.0936 to 1.7480
Iron Foundry	Hesse	0.0717	4.4762
Sawmill	Arens	0.0150 to 0.170	0.9364 to 10.6131
Snuff Factory	Arens	0.0160 to 0.0720	0.9988 to 4.4950
Grinding Mill	Arens	0.028	1.7480
Grinding Mill	Hesse	0.047	2.9342
Cement factory	Arens	0.13 to 0.224	8.1159 to 13.9843
Felt slipper factory	Arens	0.175	10.9253
Bunker on Steamship	Dirksen	0.0828 to 2.2897	5.1692 to 142.9460
Coal Mine	Hesse	0.0143	0.8927
Coal Mine average	W & N[4]	0.0354	2.2100
Coal Breaker average	W & N[4]	0.396	24.7223

[3] The figures placed in this column are not in original article.
[4] W & N Wainwright and Nichols.

The average of 25 different determinations of the dust in mines, which we have taken is 0.0354 gram per cu.m. The screen rooms in the breakers were much more dusty, giving on an average of 0.3967 gram per cu.meter.

The only other quantitative determination of the amount of coal dust in mines which we have seen in literature is that of Hesse quoted by Dirksen[2] as 0.0143 gram per cu.m. of air. A comparison of the quantity of dust in the air in mines with that in other places can be seen in Table II in the preceding column, compiled by Dirksen and supplemented by our observations.

From this table it will be seen that there are a number of places as dusty as modern coal mines. There are few places dustier than the screen rooms of breakers. In concluding we wish to thank Prof. Mendel, of Yale, and Prof. Abbott, of the University of Pennsylvania, and Dr. Sweet, of the Rockefeller Institute, for many valuable suggestions, and the latter also for placing at our disposal facilities of the hygiene laboratory, where a part of our experimental work was carried on, the other portion being done in the laboratory of the Moses Taylor Hospital, of Scranton.

[2] Dirksen. Quantitative Staub bestimmungen der luft der Kohlen bunker, Archives fur hygiene 1903. No. 11.

Nystagmus

By T. Lister Llewellyn*

Miners' nystagmus is a nerve disease which is confined to workers in coal mines. The chief symptom and physical sign is a rotary oscillation of the eyeballs, which prevents the miner from accurately locating anything toward which his vision is directed.

The man first notices that he is unable to perform the more skilled part of his work; he cannot notch timber well, and fails to strike his wedge truly, or hit with his pick the exact piece of coal at which he aims. He next complains that the lamps dazzle his eyes, that he is unable to see anything at night time, and, finally, that the lamps and all surrounding objects are going round and round. Headache, varying from slight pain between the temples to attacks of extreme severity, giddiness on exertion and stooping, night blindness, dread of light, and, in severe cases, marked nervous depression, are all found in a serious case of nystagmus, and two of my cases have expressed suicidal intentions.

There are two distinct varieties of the disease, in the first the symptoms are absent or latent, and the man apparently suffers no disability. Tables I and II are the result of an analysis of 400 consecutive cases which I have investigated up to the present time.

TABLE I

Latent	43
Manifest	357

TABLE II. ANALYSIS OF SYMPTOMS

	Subject	Marked	Very marked
Movements of objects	361	..	..
Headach	305	38	16
Giddiness	308	40	7
Night blindness	262	4	..
Photophobia	159	9	..

Note—From a paper on "The Causes and Prevention of Nystagmus," read before the Royal Society and communicated by Dr. J. S. Haldane.

*Tyndall Research Student.

Coal and Coke News

From Our Own Representatives in Various Important Mining Centers

Washington, D. C.

During the past week the Interstate Commerce Commission has followed the plan of suspending advanced railroad rates on coal whenever the question has been presented. This appears now to have become habitual—a fixed policy on the part of the commission. Pending the demonstration of a need on the part of the roads for higher rates, due to the existence of higher operating costs, due to generally larger payments for wages or other expenses, it is believed that the commission will not be likely to consider such applications with favor.

Paint Creek Resolution

Representative Wilson of Pennsylvania has offered a resolution calling for an investigation of the strike conditions in the Paint Creek Coal Field in which he says in part:

Whereas it is alleged that the owners or operators of the mines in said coal field have threatened, coerced, and intimidated the workmen in the exercise of rights guaranteed by the Constitution; that citizens of the United States and subjects of foreign countries are being held in peonage by the owners or operators of said mines; that the said owners or operators of the mines have prevented citizens of the United States and subjects of foreign countries from exercising the right of access to the United States post office at Mucklow, West Virginia, by the use of Gatling guns, clubs, and "strong-arm" men known as the "Baldwin Guards": Therefore be it

Resolved, That a special committee of five members of the House of Representatives, to be appointed by the Speaker, is hereby created to make a thorough and complete investigation of the conditions existing in the Paint Creek coal fields of West Virginia for the purpose of ascertaining—

First. Whether or not our treaty obligations with other countries are being violated; and if so, by whom.

Second. Whether or not a system of peonage is maintained in said coal field; and if so, by whom.

Third. Whether or not access to United States post offices is prevented; and if so, by whom.

Fourth. If any or all of these conditions exist, the causes leading up to said conditions.

Fifth. Whether or not the Commissioner of Labor or any other official or officials of the government can be of service in adjusting said strike.

Illinois

DuQuoin—A big coal-mine deal, which has been in progress for several weeks, is about to be closed. It will involve two large collieries of the Williamson County field. The Madison Coal Corporation, an auxiliary of the Illinois Central R.R., will acquire the mines of the Robert Dick Coal Co. and John Bros., both of which are located at Cambria. The amount involved in the transaction is not made public, but will reach well up into thousands of dollars. Neither of the mines has resumed operations since the strike of Apr. 1, but under the new management, will shortly be placed in operation.

Freeport—The Freeport Ry. & Light Co. has passed into the hands of the Insull interests. This purchase is said to mean that a number of improvements will be made here in the course of a short time. The same corporation, it is said, is the financial factor in the Peabody interests, which are securing options on nearly all coal-mining properties in Sangamon County, and in the near-by counties. This corporation is to build a mammonth water-power plant at Kincaid soon.

Monmouth—Miners and operators here, who have had a hard time trying to adjust their differences, are now pulling together.

We hear that many mines in the state have been closed, machinery stored, house boarded up, and mules shipped away. The mines have not been worked out, but are really abandoned for the present.

Indiana

Brazil—Miami Coal Co., of this city, has discovered a bed of block coal lying under the bituminous seam at mine No. 5. The mine was to have been closed early next spring. Extensive drillings were made by the company.

Indianapolis—The Indiana Trust Co. has been appointed as receiver for the Wales Coal & Lime Co. on the petition of A. E. Wales, a stockholder, who says the company is insolvent. The company was incorporated 12 years ago with a capital stock of $10,000.

Linton—Two beds of coal have been discovered here recently. No. 3 coal is 6 ft. deep below No. 4 vein, and 5 to 7 ft. thick. No. 2 is from 9 to 11 ft. thick, and would take 200 years to work out.

Princeton—The Wyoming Coal Co., operating the mine at Francisco, is sinking its shaft to a lower level and has struck a 6-ft. bed of excellent quality coal, with good slate roof. This bed is at a 230-ft. depth, about 100 ft. below the present workings. It is expected that the opening of this new seam will mean an increase in the population of the mining town of Francisco within the next few years.

Kentucky

A successor to T. O. Long, assistant mine inspector for the western district of Kentucky, will be appointed shortly. Mr. Long is unfortunate in that, though the salary attached to the position recently was increased, the present incumbent does not share the raise, as he served under a former administration.

Ashland—The Kentucky Solvay Co. is progressing rapidly with the work of installing its big coke ovens. The plant will be completed by Oct. 1, according to recent estimates. Several hundred men will be employed by the coke manufacturing concern.

Pineville—The Continental Coal Corporation recently closed down its 18 mines for a day, during which employees held contests of various kinds in competition for prizes offered by the company. Of chief interest was the work of teams of sixty men each from the various mines in life-saving contests. The tests included the reviving of victims of electric shock and gas fumes; application of the tourniquet; the dressing of minor wounds; reducing fractures, controlling bleeding and making stretchers of mining drills and tools.

Sturgis—At the instance of Senator W. O. Bradley, of Kentucky, the Senate has passed a bill appropriating $3700 for the reimbursement of the West Kentucky Coal Co. The company lost a barge of coal lines and appurtenances at Memphis, Tenn., in 1909, restitution having been long delayed by the government.

Massachussetts

Boston—The New England Retail Coal Dealers' Association held a special meeting in Boston, Aug. 21, to make some effective complaint against what they term an unfair distribution of the anthracite mined this season; in other words, the New England retailers are not getting a "square deal" from the originating and distributing companies. It seems there has been a strong feeling that line and western points were getting an undue allotment and that with the smaller shippers in particular it was because the trade in those directions netted a better return than that in New England.

President William A. Clark, of Northampton, Mass., and Secretary Charles H. Haskell, of Norwich, Conn., were directed to take the association's grievances to headquarters in New York and Philadelphia and not only learn the reason why

but demand that the shortage be made up at once. They were further directed to report to an adjourned meeting in two weeks' time. Veiled threats of asking assistance from the federal government were expressed and altogether it appears to have been quite a crisp gathering. More than 100 dealers came from all over New England, but it is fair to say that the large majority represented those receiving supplies all-rail. The statement was made that these dealers were short considerably more than one-fourth of the supply actually needed for the next few months.

Minnesota

Duluth—It is expected that there will be continued activity in coal shipping from this time until navigation closes, and the reason given is that the shipments are said to be much under those of last year, and coal is badly needed both in Duluth and Superior, and the Western territory tributary to these points.

Owing to the strike of the miners early this spring, the companies have, up to this time, been unable to get the coal from the mines to the lower Lake docks in sufficient quantities to take care of the boats awaiting it.

Recently, however, the mines have been operated under full pressure, and the result is that the coal is being rushed to the docks in great quantities. The prediction is that the final wind-up and rush of the 1912 season will be sensational.

Missouri

Belleville—The Randall coal mine, one of the largest in this vicinity, which has been shut down for several years, has been reopened by the Mulberry Hill Co. This company has purchased the property, and it will be known as the Mulberry Hill mine No. 2. About 200 men will be employed in the reopened mine.

New York

Albany—Another move in the railway consolidation game was shown recently by the plan of the New York, New Haven & Hartford Co. to the Public Service Commission to take over the Ontario & Western.

Belief that extensions to reach Lake Ontario, some of the large eastern New York cities and the anthracite coal fields of Pennsylvania would be advantageous, was the reason given for the desire to make the big expenditure involved.

Two months ago the commission denied an application by the New York Central for permission to buy the Ontario & Western stock, held by the New Haven, because it held all the energy and credit of the New York Central should be put into the public duties now placed at its doors.

It now remains to be seen if the Public Service Commission will deny the application of the New Haven road as they did the New York Central.

North Dakota

Fargo—At the conference of the North Dakota branch of the Northwest Retail Coal Dealers' Association, various matters of interest to the coal dealers of the state were discussed, including the apparent impending shortage of hard coal. It was determined to make an effort to interest the consumers of the state to coöperate with the retail dealers in preparing to meet the probable emergency. It was decided to hold the 1913 convention at Grand Forks.

Ohio

Ashtabula—The purchase of 30,000 acres of Ohio coal land in Belmont County by the Grank Trunk R.R. indicates that the proposed new line of car ferry colliers, to be run from Point Burwell to ports on this side of Lake Erie, will be engaged in part in hauling the products of the Grand Trunk's own mine.

Beverly—The Sycamore Coal Co., of Beverly, Ohio, has decided to open the Old Sycamore Mine, at Coal Run, near this town. A new corporation will be formed and will take over the property and operate it. M. M. Rose is at the head of the new company and associated with him are a number of well known business men of southeastern Ohio.

Columbus—President John Moore, of the Ohio miners' organization, and coal operators of Lawrence County, met Thursday at Ironton, in an effort to settle a strike which has existed in that county for two years. Over 1000 miners have been out of work during that time.

Hamden—Eight thousand acres of coal land in Scioto and Lawrence counties have been sold recently. It is understood that the land was bid in at $32,005 for F. W. Worthington, a Portsmouth oil operator, who intends converting it into a stock farm.

Vinton—The Vinton Furnace property, owned by four Philadelphia capitalists, is being thoroughly drilled for estimates on the deposits of No. 2 coal.

Over 7000 acres are held by this company and a hole is drilled on every 40 acres, and so far no blanks have been found. About 30 men are at work on the property, getting everything ready for the large business which they expect to carry on during the winter.

Already the company plans to get the coal in shape for the same use as anthracite coal, and a plant will be built for that purpose. It will be modified, that is, reduced to small pieces, and it is said to be an excellent steam coal. This plant will be the only one in this section of the country.

Wellston—The C. K. Davis Coal Companies property, formerly known as the Old Lincoln Furnace lands, was sold at public auction, at Jackson, recently, and was bid in by Albert G. Thorn, representing a New York syndicate. The mines will be operated, it is said.

Pennsylvania

Anthracite

Pottsville—Bore shafts, completed at the Herbein colliery, operated by the St. Clair Coal Co., have relocated the mammoth bed, abandoned 50 years ago, after it had been worked so little as to have left it practically virgin coal. A shaft will be sunk by means of which it is expected that coal can be mined for at least 50 years. It is said that the new developments will yield at least 10,000,000 tons of the finest quality of anthracite coal in this locality.

Shamokin—The Philadelphia & Reading Co. has started to drive a slope in Zerbe Township to tap one of its many virgin tracts of coal.

All the territory in the immediate vicinity has never been touched and great deposits of anthracite are contained in the soil.

The company is operating three shifts of men with the idea of having the slope driven for winter. It is thought by experts that Bear Valley will prove to be the richest producing land yet opened by the Reading.

Wilkes-Barre—The Hollenback colliery resumed operations Aug. 16. The company has promised to meet with the Grievance Committee of the colliery, and if an adjustment cannot be reached relative to wages and other conditions, the matter will be referred to a conciliation board.

Bituminous

Beaver—Surveyors for the New York Central lines are laying out a new road to connect Lisbon, Ohio, and Beaver, Penn., via Wellsville and East Liverpool, Ohio, for the purpose of gaining an entrance into the extensive coal fields near West Point, Ohio. The new line will also provide an outlet for the Erie, which will then be enabled to handle the tonnage from East Liverpool and Wellsville.

Centerville—After 35 years of operation, the Clarissa mine of James Cochran Sons & Co. has been closed down permanently. The shutdown includes 108 old-style beehive coke ovens, and represents one of the old coal workings in the Connellsville region.

The coal was mined from the old farms of Robert Boyd, James Rankin and Samuel Harper. In the early days the coal was hauled to the surface by horses and mules, and the larys charging the ovens were operated by mules. Many thousands of cars of Connellsville coke were produced from this old working.

Connellsville—Two more bodies have been recovered from the Polecat mine of the Superba Coal Co., of Evans Station,

and others of the 11 bodies still in the mine may be reached at any time.

It is rumored that the Superba Coal Co. has no intention of abandoning the Polecat mine. An official of the company recently made the following statement:

> We are going to clean the mine out and go to work again. We are laying and repairing track into the mine as the water falls. Also we are building a concrete manway. Does that look as though we intended to close the mine up? No, sir; we are going to work again as soon as we can.

There are nearly 50 men engaged in emptying and cleaning the mine, and the hole through which the water first poured has been filled. The slate taken from the mine will be dumped around the new concrete manway, filling the other hole which admitted water to the mine July 24. The work of repair has penetrated 1700 ft.

Johnstown—Three thousand acres of Somerset coal land are to be transferred to a Philadelphia concern soon, the name of which has not been made public. The tract extends from the Somerset Borough line almost to Geiger Station, and through it passes the Somerset & Cambria branch of the B. & O., the Boswell extension of the B. & O., and the Westmoreland & Pittsburgh R.R.

This tract is one of the finest in Somerset County, containing all the seams from the upper Freeport on down over the entire acreage. Engineers for the Philadelphia concern have completed surveys and have been drilled, making immediate development possible. The deal will be completed within a few days.

Pittsburgh—The Western Allegheny R.R. may become a part of the Bessemer & Lake Erie System, as a result of the passing of the Great Lakes Coal Co., into the hands of a receiver. The coal company has extensive interests in Butler and Armstrong counties. The Western Allegheny is 57 miles long and runs from Queens Junction to West Pittsburgh, connecting with the Bessemer & Lake Erie at Queens Junction. The road costs $2,000,000 and for a time was operated as a branch of the Bessemer.

The line taps rich territory and its entrance into Newcastle and West Pittsburgh would mean much to the United States Steel Corporation, since the ore could be hauled directly to Newcastle from Conneaut Harbor without passing over a foreign line.

A meeting to adjust the differences between the United Mine Workers of the Pittsburgh district and the Pittsburgh Coal Co. was held Aug. 22. There are about 15 mines of the company at which these differences exist.

Progress toward adjustment was made at a conference, Aug. 21, when the strike at the Manown mine, at Monongahela, was settled.

Roscoe—The Old American mine of the Vesta Coal Co. began operations last week. Men have been engaged under the direction of Elijah Dainty, of Charleroy, in cleaning up the mine.

It is expected that approximately 150 men will be given work and that the production will run up to 700 or 800 tons of coal per day. Four or five years ago the mine was discontinued when the Vesta Coal Co., which owns it, started taking coal through the Vesta No. 2 opening.

Tennessee

Knoxville—Mine owners in the Jellico coal fields are refusing to quote prices on future deliveries, it is said, because of the fact that the present wage agreement, which expires September 1, has not yet been renewed. Negotiations which have been held between the operators and district executive officers of the United Mine Workers have as yet been fruitless, no decision having been reached. The meetings have been held at Knoxville, Tenn.

Union mine owners of District No. 19, United Mine Workers, comprising eastern Tennessee and southeastern Kentucky, have ignored the request of officers of the miners for conference to date to fix a new wage scale. The present scale expires Aug. 31, and, unless there is an adjustment, the miners say a strike will be ordered.

Oakdale—Richards & Son, of Rockwood, have sunk a shaft for coal and have found a 3-ft. seam at a depth of 70 ft. The coal is of fine quality, and the mine is within the corporate limits of Oakdale.

Thomas Norman, the superintendent, says that the mining machinery will be placed in a few days, and the erection of buildings for the employees will be started at once.

Texas

Poteet—The Poteet Coal Co. is said to be mining coal at a rapid rate. It is pronounced to be the best lignite Texas has so far produced. When the full force is at work, the mine employs 300 men.

Utah

In Bulletin 471-I, the United States Geological Survey has given a preliminary but very thorough and rather extended review of the coal fields in Utah. An extract follows:

The coal beds occur in two groups. The higher is in the Mesaverde quartz formation and contains at least 21 beds in a stratigraphic distance of 1650 ft. The lower group is in the lower part of the Mancof shale, about 3500 ft. below the upper group, and consists of four known coal beds in a stratigraphic distance of 250 ft.

West Virginia

Governor Glasscock is expected to name a commission of five almost any day to take up a study of the conditions. The commission will be composed of two operators, two miners and a fifth man selected by the four. Their findings would be placed before the next session of the Legislature and it asked to enact laws to change conditions now alleged to be existing in the coal territories of the state.

Elizabeth—The West Virginia University has organized a school of mines in response to a demand from the mining interests of the state, primarily for the young men in the mining districts to whom the opportunity of a high-school training is denied. Its aim is to provide a practical and theoretical training for those who wish to follow mining as a profession and whose preparation and available time are not sufficient to take the regular four-year college course.

The full course extends over a period of three years of 24 weeks each, but the work has been so arranged that much benefit may be derived by attending one or two years.

Elkins—The mines of the Davis Colliery Co., at Junior, which have been closed down for several years, are being renovated. It is expected that they will be running at a full force of 200 men within a short time.

Colombia

Attention is being attracted to the coal deposits along the north coast of Colombia; many apparently important coal beds have been discovered and located, but so far no development work has been done upon any of these.

Japan

What is perhaps the most extraordinary coal mine in the world, as well as the smallest, is situated on a small island in the Japan Sea, near Nigasaki, and has sufficient room upon its surface for the shaft and hoisting machinery. The workings are very extensive and reach in all directions, under the sea.

Portugal

A British consular report mentions that on May 23, 1911, a decree was issued imposing an export duty of 150 reis per ton on pit props exported from Portugal. This was done to save the forests, which were getting rapidly cut down and complaints were made at the time that this duty would be prohibitive. The figures for 1911, however, do not support this, for the duty has in point of fact not diminished the exportation to any great extent as shown:

	Metric Tons	Dollars
1909	116,000	321,750
1910	130,000	411,220
1911	106,575	354,375

Personals

P. J. Johnson, of Lexington, Ky., is president of the Coney Cannel Coal Co., which has recently been organized in Paris, Ky.

J. M. Page, assistant superintendent of Pratt No. 1 Division of the T. C. & I Co., has been transferred to the position of Division Engineer of Pratt No. 2 Division, to succeed Mr. Postell.

Charles Baily, for many years a clerk and employed in different responsible positions under the Berwind-White and Westmoreland coal companies, has been promoted to the superintendency of the Westmoreland Coal Co.'s mine at Claridge.

John F. Brown, assistant superintendent of Pratt No. 2 Division, has been transferred to the position of assistant superintendent of Pratt No. 1 Division, to succeed Mr. Page.

George W. Postell, Division Engineer of Pratt No. 2 Division, has been placed in charge of pumping out and reopening the old Helena mines on the Birmingham Mineral Branch of the Louisville & Nashville R.R., which were abandoned several years ago.

Angus R. Brown, in charge of the government rescue station at Birmingham, Ala., and a brother of John F. Brown, and a former employee of the T. C. & I. Co. for many years, has been appointed assistant superintendent of Pratt No. 2 Division to succeed his brother, John F. Brown.

Angus R. Brown's successor in charge of the government rescue station has not yet been appointed.

Capt. John C. Davidson, who designed the plant of the Nebo Consolidated Coal & Coking Co., at Davidson, Ky., several years ago, has located in Louisville as the representative of that concern, of which he is a director. Capt. Davidson has established wholesale offices in the Keller Building.

A. O. Krieger has resigned his position as publicity manager of the Busch-Sulzer Bros.-Diesel Engine Co., of St. Louis, Mo., with whom he had been connected for a number of years, to open an office at 916 Victoria Bldg., St. Louis, for the sale of the Tacchella Oil-Burning Device, a new device which will be especially suitable for domestic heating purposes, japanning and annealing ovens, baking ovens and cooking ranges.

Obituary

P. T. Koenig, vice-president of the P. Koenig Coal Co., died at his home, 772 Helen St., Detroit, Mich., after an illness of several months, Aug. 12.

When a young man, he became associated with the P. Koenig Coal Co., and recently was elected as its vice-president.

Construction News

Wilkes-Barre, Penn.—Charter of the West Nanticoke Coal Co. was filed yesterday with the recorder of deeds. The purpose of the corporation is the mining, prepar ing and selling of anthracite in coal. Offices are in the City Exchange Building in this city. The capital stock is $40,000. A. D. Smith, 370, C. B. Metzgar, 20, A. J. Smith, 10 shares.

Caldwell, O.—Initial steps have been taken by the Belle Valley Coal Mining Co. toward locating a new coal mine near the Abel Whealdon homestead running the spur up to the Dod Run Valley. W. J. Johnston has secured lease of 1200 acre block lying east of the company's present holding and testing will begin at once with a view to locating the mine. Coal was taken at $15.00 per acre.

Barbourville, Ky. — Abstractors are working in Barbourville and Manchester running down the abstracts and title on thousands of acres of Knox and Clay county mineral lands. The Knox Coal Co. a corporation recently formed will take over about 75,000 acres of these lands for development purposes.

Pottsville, Penn.—St. Clair Coal Co., is driving a bore hole west of the creek at their St. Clair plant in an endeavor to locate the Mammoth vein. When it is properly located it is the intention to drive a shaft.

Logan, O.—The Hanna-Essex Co. on the Peach Run branch of the Z. & W. is rapidly opening its entries for the new mine. Coal is being shipped by wagon, the switch is rapidly being built. The coal lies near the bottom of the creek and a hoisting machine will be necessary to get it to the tipple.

Columbus, O.—The W. J. Hamilton Coal Co. has increased its capital from $50,000 to $100,000 to take care of growing business. This company is a consolidation of the Hamilton and McManigal interests and do both a producing and a jobbing business. The company operates the Black Nancy mines in West Virginia and does a general shipping business. The increase in capital was necessary through the need of a larger working capital with which to conduct the business. Most of the new stock will be taken by the present stockholders of the company. S. A. McManigal is president of the company and W. J. Hamilton, vice president and general manager. The offices of the company are in the Shultz Building.

Elkhorn City, Ky.—More than 1,000 laborers have been assembled in Eastern Kentucky for construction work on the forty-mile extension of the Carolina, Clinchfield & Ohio railroad from Dante, Va., to Elkhorn City, Ky., and it is stated that 5,000 men will be put to work shortly. The road will penetrate the mountains which now separate the rich Elkhorn coking coal fields of Eastern Kentucky from a direct outlet to tide water. A series of thirty-eight tunnels will make the undertaking one of the most expensive ever attempted in Kentucky and possibly in the entire country. One tunnel will be four miles in length. On the mountain which is to be penetrated, a perpendicular shaft is now being bored, and workmen are boring in both directions toward that point. That work alone will cost $5,000,000. The completion of the extension will give coal operators a short line from the newly-opened fields in Pike and other Eastern Kentucky counties to the Carolinas and tidewater points, providing a connecting link with the Seaboard air line.

Publications Received

SUBWAYS AND TUNNELS OF NEW YORK. By Gilbert H. Gilbert, Lucius I. Wightman and W. L. Saunders. First edition, 1912. 372 pp. 6x9¼; 128 illus.; 20 inset plates; 28 tables. $4, net. John Wiley & Sons, New York.

The subways and tunnels of New York while on a scale and built under difficulties unlike those encountered in coal mines, nevertheless have a considerable bearing on everyday colliery practice. When shafting through quicksands, drilling tunnels through rock and passing under treacherous top, problems like in kind if not in degree are encountered and hints can be drawn from this book as to the best methods to meet the difficulties when presented.

The real reason why this book will fit but little into our mining practice of today is because so far we have failed to take advantage of rock-drilling machinery in coal-mining work. If we had machinery which would accelerate rock work, more mine roads would be graded and deeper ditches excavated. Many grade changes are unmade because the time for making them is inadequate unless the work is undertaken in several stages with consequent disorganization and temporary grades far worse than those we would remove.

We commend this book to our readers because it gives information relative to methods of working which in part are not in use in the mines, but very shortly should be and will be used. It has an appendix, occupying fully half the book, full of practical data relative to drilling, air compression, air lift pumping and blasting. To those who are interested in the marvellous subway and tunnel system of New York City with its net-work of underground and subaqueous railways built under the most unfavorable conditions, this book will have a great value altogether apart from its technical applicability to coal mining needs.

We consider it the duty of every man who would keep up-to-date in coal mining to read about the work of allied branches especially tunneling because development will be rapid when once a start is made along lines hitherto neglected by mine officials.

Industrial Notes

The Mud River Development Co. has recently purchased the old Mud River tract, (4000 acres), located in Butler and Muhlenburg Counties and has raised $50,000 to be expended for developments and improvements with the expectation of producing from 2500 to 4000 tons per day.

The following analysis has been made of the coal by Prof. Wharton of Nashville, Tenn.

Moisture 3.93, volatile matter 36.68, fixed carbon 57.62, ash 3.77, sulphur 0.67.

It will thus be seen that this coal is of a hard semi-cannel and the seam averages 4 feet 6 inches in thickness.

Coal Trade Reviews

Current Prices of Coal and Coke and Market Conditions in the Important Centers

General Review

Some buying of hard coal for domestic purposes developed during the week, and it is believed this trade will be definitely under way after the first of the month. Dealers are beginning to receive inquiries from the domestic consumers, and when this buying movement sets in actively, the anthracite shortage will become a reality.

Complaints are general that insufficient hard coal is being received to meet current orders. The demand is still far in excess of the supply, and the production is being as readily absorbed as ever. In the Northwest the receipts at the Upper Lake docks, to the first of this month, are only equal to half those for the same period last year; at St. Louis both the August and September circulars have been withdrawn.

In the Eastern bituminous market there has been a noticeable improvement, particularly in the steam demand; consumers of this grade are now seeking to cover their requirements against a possible car shortage during the coming season. Rumors of the slow movement and a heavy demand for the export trade has caused a mild scare, and it seems probable supplies may be quite low during the season.

In the Pittsburgh district the demand and prices are not materially changed, but the steam consumers are calling for somewhat heavier shipments on contract in anticipation of the impending car shortage; prices are being rather closely held and operators are showing a tendency to curtail production.

The Ohio trade is reported active and firm, with the proposed Sept. 1 advance in prices now practically assured. The car shortage is growing, the lake movement continues good, and there is a strong run of orders for domestic, with requests for immediate shipment. In West Virginia the trade is excellent, with no appreciable accumulations at any point, and the prices generally firm or advancing.

There is a heavy demand in the Northwest which the dealers are unable to meet because of the small stocks on hand; the hard-coal shortage is causing some of the demand for this grade to be diverted to the bituminous. Some sizes are reported in an exceptionally strong position, and commanding ready premiums. In the Far West the railroads are stocking heavily, in anticipation of a possible strike, as a result of the coming labor conferences.

Boston, Mass.

Rumors of detention at Hampton Roads has caused uneasiness here over the outlook for supplies of bituminous, and there is a mild scare among certain of the buyers. There is a large volume of coal to be loaded for export early in September and it is more than likely that many of the smaller consumers inland will be caught without sufficient reserve for the winter. There has been some apprehension, too, on account of the possible spread of the strike in the Paint Creek district on the C. & O. Ry. It would be taking a serious turn if it should extend into the New River field. Prices on Pocahontas and New River are firm and the pressure now is toward obtaining coal rather than to be relieved of it.

Bituminous all-rail from Pennsylvania is in good demand and the market in a healthy state. Georges Creek also shares the general firmness, and practically all of that and the favored grades from Pennsylvania are coming forward on contract requirements. The output in most cases is well above the average. No spot market of any moment has developed as yet but it is only a question of weeks probably when there will be an active demand for quick coal.

Anthracite is now the occasion of much alarm. The meeting of the New England Retail Coal Dealers Association here on Aug. 21 shows how widespread is the feeling that this section has not had its fair proportion of what coal has been mined. Most of those represented at the meeting were dealers who get their supplies all-rail; to those so placed that they can view the trade as a whole it seems as if the tide-water people have more cause for complaint, and that the general situation is simply the logical outcome of the suspension in mining.

Dealers are rapidly coming to the opinion that any size whatever will look good when winter arrives. The Boston retailers advanced prices, Aug. 26, 25c. on all sizes but chestnut, making stove and chestnut $7.75, egg $7.50, broken $7, and pea $6.

Wholesale quotations are as follows:

Clearfields, f.o.b. mine	$1.10 @ 1.35
Clearfields, f.o.b Philadelphia	2.35 @ 2.60
Somersets, f.o.b. mine	1.25 @ 1.45
Somersets, f.o.b. Philadelphia	2.50 @ 2.70
Pocahontas, New River, f.o.b. Hampton Roads	2.70
Pocahontas, New River, on cars, Boston	3.80 @ 3.90
Pocahontas, New River, on cars Providence	3.65 @ 3.80
Antracite stove, f.o.b. New York	5.20 @ 5.50

New York

Bituminous—The New York soft-coal market has shown a still further improvement during the past week, and is now quite firm. This applies, however, more particularly to the better grades, those of inferior quality still being relatively weak. There has been a noticeable reduction in the surplus of the better grades during the week, but the ordinary kinds are still plentiful.

The car shortage has become more pronounced, with the result that shipments from the mines have been rather slower than customary. This, together with the labor troubles in the Paint Creek district in West Virginia, has exerted a stimulating effect on market conditions. Should the Paint Creek strike spread to the New River district, there will be a decided shortage of soft-coal this season.

Prices are unchanged, but quite firm and hard, especially on the better grades, as follows:

West Virginia, steam	$2.35
Ordinary grades Pennsylvania	2.45
Fair grades, Pennsylvania	2.60@2.70
Good grades, Pennsylvania	2.75@2.80
Best Miller, Pennsylvania	2.95@3.00
Georges Creek	3.15

Anthracite—There has been no perceptible change in the hard-coal situation during the week. There are no evidences of any surpluses being accumulated, and the belief is that there will be an acute shortage, particularly in the domestic grades, when the season opens up in full blast. It is expected that the retail trade will become quite active after the first of the month and that the effects of the shortage will then become evident.

While President White, of the mine workers, has completed his tour of the hard-coal regions, which resulted in seriously interfering with the production, there are a number of petty strikes at the different collieries which are still tending to reduce the capacity of the mines. However, arrivals are coming in fairly well, although not to such an extent as to effect any material reduction in the shortage.

New York wholesale quotations continue quite firm as follows:

	Upper Ports	Lower Ports
Broken	$4.90	$4.50 @ 4.90
Egg	5.15	5.05 @ 5.10
Stove	5.15	5.10 @ 5.20
Nut	5.40	5.20 @ 5.35
Pea	3.50	3.30 @ 3.45
Buckwheat	2.75	2.15 @ 2.55
Rice	2.25	1.75 @ 1.95
Barley	1.75	1.60 @ 1.70

Pittsburgh, Penn.

Bituminous—Manufacturing consumers are calling for slightly heavier shipments on contract, in anticipation of a serious car shortage in September and October. Demand is unchanged as regards new sales, and prices are not materially different, being considerably under the nominal or list for the season. Mine operations have been curtailed here and there on account of heavy rains, and there are also minor labor disturbances, on the claim that the scale is not being complied with.

We continue to quote: Mine-run nut, $1@1.05; ¾-in., $1.25; 1¼-in., $1.35; while we quote slack at 50@60c. instead of 50c., all per ton at mine, Pittsburgh district.

Connellsville Coke—Since the fairly heavy sales of contract furnace coke at $2.25, reported last week, the market has become well established, and additional contracts have been closed at the same figure, making 40,000 tons a month or more sold for the balance of the year in this movement. Sellers are now stiffer in their price views, and it appears that little more coke can be had on contract except at an advance.

While there are reports of $2.35 or $2.40 having been paid these are not yet verified. Prompt coke has been in excellent demand, sales of 10,000 or 15,000 tons having been made since last report, at $2.25. Prospects are that additional furnaces will go into blast, and as production is now practically up to the limit, under present labor conditions, a stiffening in prices is to be expected. Foundry coke continues in fair demand.

We quote: Prompt furnace, $2.25@2.30; contract furnace, $2.25@2.35; prompt foundry, $2.40@2.50; contract foundry, $2.40@2.75.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended Aug. 17 at 374,101 tons, a decrease of 12,000 tons, and shipments at 3951 cars to Pittsburgh, 6268 to points west and 890 cars to points east, a total of 11,109 cars, a decrease of 342 cars.

Philadelphia, Penn.

The dealers are already receiving numerous inquiries from consumers who are laying in their winter supplies of hard coal, to all of which they can make but one reply, that orders will be filled as promptly as possible. Deliveries are necessarily slow, owing to the short supply of certain domestic sizes, but the dealers say they hope that conditions will be better in the near future. As a matter of fact, it is not believed that there will be any easing up all through the winter.

Complaints are coming in from all directions, that coal is not being received in sufficient quantities to fill current orders, and when the one and two lot orders commence to arrive there is likely to be an added complication. The week just passed has shown a marked increase in the output of anthracite, in favorable contrast with the week preceding. President White has finished his tour of the region, and the men have knuckled down to work again, with the result that there is a better production. Even the individual operators, who are usually willing, at this season of the year, to market their production at considerably less than the so called circular, are turning a deaf ear to any suggestions of a cut, and, in some instances, are willing to entertain a premium. There is practically no price cutting, excepting possibly on some of the steam sizes, and this in only isolated cases, where the cars are likely to go on demurrage, awaiting consignment. Improvement still marks the bituminous trade, although it is rather gradual.

Prices are adhered to, and there is very little surplus coal in the market, the operators holding their output to the orders on hand and in sight.

Baltimore, Md.

The Baltimore market is now feeling the effects of the marked improvement in the coal trade. The better demand started in the early part of the week and has continued, unabated ever since. Spot business has improved and more coal is also being moved under contract. Prices have also advanced, particularly on the lower grades. But little of these are being sold for less than 90c., which is an advance of from 10 to 15c. over the prices quoted four or five weeks ago. The prices of the better grades are holding firm.

The movement from the West Virginia mines to tidewater is by no means good. A shortage of cars is now the complaint, and operators fear that equipment is going to be difficult to obtain later on. To obviate any serious trouble, many of the larger companies are sending out letters to the trade, requesting that they increase their orders at this time, as there is better opportunity of making prompt deliveries than there will be later. It is not believed these letters are due to any motive of self-interest, as the coal companies could probably obtain better prices later on.

So far, the B. & O. has been able, for the most part, to handle the coal traffic satisfactorily, and President Willard is quoted as saying that his company is well prepared for the fall business. On the Western Maryland, officials are worrying over the inadequate equipment supply.

The coke market is showing signs of improvement. The product began moving more freely under contract during the week, and the trade looks for a slightly better demand from now on, because of the activity in the steel industry.

Buffalo, N. Y.

The bituminous trade gains in strength slowly but steadily, and promises to continue so for some time, as the consumption has not yet reached its highest for the year nor the effects of the car shortage been felt. There is a visible increase in the scarcity of cars and it is reported that the shortage is much worse in the West than here.

The slack trade is still firm, except where it is dependent on the Lake movement; it is bound to suffer there because so much has been moved West, which is still on the upper-Lake docks. It was predicted a short time ago, that Alleghany Valley slack would sell on a mine-run basis this season; it has done so now and then in former seasons.

While the bituminous prices are steadily growing stronger the actual figures are about the same, the real difference being that there are no more reports of price cutting, as was the case a while ago. On the other hand, the operators are more likely to report that they are short of miners.

Quotations are strong at $2.57½ for Pittsburgh three-quarter, $2.47½ for mine-run and $2 for slack, with Alleghany Valley sizes from 15 to 25c. lower. The coke situation is also very st[illegible] a shortage of men being still more general at the ovens than in the mines proper. Prices are on a basis of $4.50 for best Connellsville foundry.

The demand for anthracite is as much in advance of the supply as ever, the steadily increasing production being taken up as fast as it appears. Stove is the size most wanted, though all sizes are much behind the demand. The anthracite companies are feeling somewhat easier, as the production is much more what it should be now than it was for some time after the resumption of mining. The week's shipments of anthracite by Lake were 180,000 tons, a very large amount.

Columbus, Ohio

The coal trade in Ohio continues active in almost every department and the outlook for the future is bright. Prices have been ruling firm in every particular, and it is now practically settled that there will be an advance to higher levels about Sept. 1. Domestic lump will be advanced to $1.65, while three-quarter inch will be $1.45.

The best feature of the trade has been the good run of orders received for the domestic sizes. Dealers are now in the market for stocks and are asking for immediate shipment in an effort to cover. This includes both Hocking lump and the fancy grades, although the latter is in the best demand for storage purposes.

The Lake trade is holding on well, despite reports of congestion from ports in the Northwest. The movement off of the docks is increasing, which is aiding in

relieving the congestion. Dock prices are firm at the level which prevailed for the season. The indications are good that the Lake trade will remain fairly active to the close of navigation.

There is a growing car shortage reported from most of the mining districts of the state. It is worse on the B. & O. and the T. & O. C., although some complaints have been heard from operators along the Hocking Valley. It is believed that the shortage will continue from this time on and grow worse, although the closing of the Lake trade may relieve the situation temporarily.

Some labor troubles have been reported both from eastern Ohio and the Hocking Valley, but not sufficient to curtail production to any great extent. Production has been about normal during the week, despite the car shortage and several holidays.

Retail trade is rather active in Columbus and vicinity and dealers are pretty busy. Some of the larger private consumers are stocking up on fancy grades. Retail prices are ruling firm.

Quotations in the Ohio fields are:

	Hocking	Pittsburgh	Pomeroy	Kanawha
Domestic lump	$1.50		$1.50	$1.50
¾-in.	1.35	$1.15	1.35	1.30
Nut	1.10		1.25	
Mine-run	1.15	1.00	1.15	1.05
Nut, pea and slack	0.40		0.40	0.40
Coarse slack	0.30	0.45	0.30	0.30

Hampton Roads, Va.

Business continued splendid at Hampton Roads during the past week. The situation might be termed as tight; vessels put in their appearance, in most cases, about the same time the coal arrived at the different piers. One or two shippers have an accumulation of coal but most of them are unable to get an extra supply. Smokeless is greatest in demand but a number of inquiries and sales have also been made for high volatile coals. A local concern has closed a contract during the past week for 15,000 tons of high volatile gas coal for shipment during the next year to Brazil.

The circular price of $2.70, Hampton Roads, largely prevails, although a number of quotations have been made on the $2.80 to $3 basis. All shippers have now advanced their prices on smokeless for local delivery from $1.10 to $1.25 per net ton. Shippers are being handicapped at their mines by a car shortage, which at this season of the year is hard to account for. The C. & O., Virginian and N. & W. all have orders in for more coal cars, which will be put in service within the next 60 days.

There is no letting up in the strength of vessel rates. From a reliable source we hear that vessel owners do not know what to ask. The prospect for a large foreign export is very bright. The high vessel rates, however, are a troublesome feature that is hard to overcome.

Nashville, Tenn.

There is little improvement in the coal situation in the west Kentucky field. The weather still continues warm and there is quite a backward movement on domestic coals, but business is picking up in a small way and by the first of the month quite an improvement is expected.

Every indication points to quite a shortage of cars on the L. & N. R.R.; even with the small demand up to the present time, they have not been able to fill it satisfactorily and when the fall business starts the chances are that there will be a very decided shortage. Prices remain about the same, although the screening market is a little weaker.

Indianapolis, Ind.

Coal mining conditions in Indiana have made fairly good progress during the past week. Aside from some labor troubles and consequent idleness, the miners have, as a rule, been well employed, and the output is slightly in excess of the corresponding period of last year.

Steps have been taken by freight traffic departments of the various coal carrying roads to assist in the fight to ward off a car famine during the fall months. Instructions have been issued to freight solicitors requesting them to urge shippers to lend assistance to the railroads in their efforts to prevent a car shortage. The Indiana Railroad Commission is likewise advising railroads to have cars ready and properly distributed to the mines, and that the operators have coal ready for loading when the cars are placed.

These combined efforts are expected to do much toward averting a car famine, which appears to be at hand earlier than usual this year. Coal prices remain about the same; there has been no increase since Aug. 1, although another is expected soon.

Detroit, Mich.

Orders for all kinds and sizes of coal are coming in freely. The demand is great for the larger sizes, which some of the dealers are unable to supply, there being little in stock.

It was thought for a while that there might be more anthracite shipped to this point, but now that the stock is so slow in getting here, everyone is alarmed. A great many of the larger consumers are looking to the Pocahontas fields to take care of their wants in place of hard coal, and owing to the increased demand for smokeless, it now seems as though the price will advance more than 25 per cent. within the next two or three weeks.

Large users of steam coal, who are not already under cover are quite anxious to close contracts at almost any reasonable price. Owing to the strike which is now on in the West Virginia fields, the operators are a little reluctant to tie up a large tonnage, which in the end they would be unable to ship, if the strike became general. Shippers claim that in case of no strike there will be much better prices later in the season.

The prevailing prices for today are as follows:

	W.Va.	Smokeless	Pittsburg	Hocking
Domestic lump	$1.65			$1.50
Lump and egg		$2.25		
¾ lump	1.25		$1.15	1.30
Washed nut				1.45
Washed pea				1.10
Mine-run	1.05	1.25	1.05	1.15
Slack		1.00	0.80	

Anthracite—There does not seem to be any uniform quotations on hard coal; owing to the severe scarcity the prices range from $7.50 to $8.50 on egg and stove, and proportionately on other sizes. Detroit does not expect to get over 30 per cent. of its consumption this year.

Coke—The manufacturers of coke are refusing to take orders for future shipments, and the price has advanced 25c. a ton.

Chicago

Smokeless coal occupies an exceptionally strong position in the Chicago market, and for mine-run there is a heavy demand at $1.25, the mines, the circular price; an advance is expected. Lump and egg are at a premium, the current price being $2.25, as compared with the circular price of $2.

There is a widespread demand for anthracite coal as a result of the belief that there will be a scarcity in that product before long. There are members of the trade, however, who are inclined to doubt reports concerning a shortage of anthracite. Low-grade screenings sell for from 45 to 50c. with the higher grade commanding 60 to 70c.

Prevailing prices at Chicago are:

	Sullivan Co.	Springfield	Clinton	W.Va.
4-in. lump	$2.47			
Domestic lump		$2.17	$2.27	
Egg	2.37			4.05
Steam lump		1.87	2.12	
Mine run	1.99½	1.82	1.92	3.30
Screenings	1.32	1.27	1.27	

Coke—Prices asked for coke are: Connellsville, $5@5.10; Wise County, $4.85@5; byproduct, egg and stove, $4.75@4.90; byproduct, nut, $4.50@4.60; gas house, $4.65@4.75.

Minneapolis—St. Paul

The coal business in the northwest continues very brisk and operators are pleased at the new conditions. Prices are better and orders are coming in without solicitation.

There has been no improvement whatever in the anthracite situation at the head of the Lakes since the first of August. Stove coal is very scarce, and, in fact, the scarcity of anthracite is beginning to be felt in this territory. The dealer trade have just begun to realize

the true condition, but the consumer is not much concerned about getting his coal for the coming winter. Anthracite receipts up to July 31 on all docks at the head of the Lakes show only 260,000 tons as against 520,000 tons at the same date last year. The same shortage will hold good during August, as it has been coming up very slowly, some docks receiving scarcely any cargoes.

The receipts of bituminous coal at all the Duluth-Superior docks up to and including July 31, is estimated at 3,150,000 tons, or 1,500,000 tons more than at the same date last year, so it will be seen that receipts are above normal on soft coal. The total amount of coal handled over the docks last year was 7,286,000 tons, so that almost half the tonnage handled during the season has thus far been received. In order to handle 7 or 8 million tons over the docks, it is necessary that half of the storage capacity be moved to the consumer to make room for the other 3 or 4 million tons that is needed to last through the winter. There is three months of navigation left in which to bring up a sufficient quantity to supply the demand, and it is now up to the dealer and consumer to fill up their storage capacity.

St. Louis, Mo.

There was a slight falling off in the market the past week, perhaps on account of the warm weather. Standard coal is still below the cost of production; lump advanced about 5c., but screenings dropped about 10 cents.

The Carterville market is about the same. All circulars on anthracite for August and September have been withdrawn, as the operators advised they have no more coal for this territory. The demand for coke is letting up some, although it is somewhat scarce. The same applies to smokeless.

The prevailing market here is about as follows:

Franklin County	
6-in. lump and 3x6 egg	$1.40@1.50
No. 1 nut	1.20@1.30
No. 2 nut	1.10@1.15
No. 3 nut	0.90@1.00
Screenings	0.55@0.60
Carterville	
6-in. lump and 3x6 egg	$1.30@1.40
Nut	1.00@1.20
Screenings	0.50@0.60
Mine-run	1.05@1.10
No. 1 washed	1.50
No. 2 washed	1.10
No. 3 washed	1.00
No. 4 washed	0.85
No. 5 washed	0.60
Trenton	
6-in. lump and egg	$2.00
Murphysboro Big Muddy	
Lump and egg	$2.00
Mount Olive	
6-in. lump	$1.35@1.40
2-in. lump	1.20@1.25
Screenings	0.50@0.55
Standard	
6-in. lump	$1.10
2-in. lump	0.90
2-in. Screenings	0.50

Portland, Ore.

The railroads in the Northwest are buying large supplies of coal and dumping it at convenient points to be used in case of labor troubles at the mines. It is reported that shipments to these supply stations have been extraordinarily heavy for sometime and that they will continue until the surplus in sight will be sufficient to answer a heavy demand.

The local demand for coal is about the same as it has been for the past three months, with possibly a slight increase as a result of the approach of fall and winter.

San Francisco, Calif.

Conditions are unchanged since last report; the demand for domestic coal is very restricted with no likelihood of improvement in the immediate future.

There can be no question but that the Rocky Mountains product is finding favor in the eye of the consumer; at interior terminal points it is in increased demand, and is certainly getting its share of the business.

Prices to the dealer are unchanged as follows:

Wellington (British Columbia)	$8.00
Pelau Main (Australia)	8.00
Rocky Mountain	8.00
Cumberland	12.50

Production and Transportation Statistics

The Car Situation

As was to have been expected, there was a further considerable reduction in the number of freight cars idle on Aug. 15. In the Middle West the largest difference in surpluses was shown by this report. Both coal and box cars were in active demand. A somewhat heavier need for coal cars reduced totals in the Virginias and Carolinas.

The following table shows the surplus and shortages of cars on 184 roads on Aug. 15:

	Surplus	Short	Net Surplus
Box	27,559	6,413	21,146
Flat	2,301	2,558	257
Coal, gond. and hopper.	4,658	4,703	4,955
Other kinds	19,105	1,048	18,057
Total	58,623	14,722	43,901

On the corresponding date last year the net surplus of idle cars was 104,170. Two years ago it was 78,760, in 1909 157,415, and in 1908 252,149.

Sault Ste. Marie Canals

Coal movement through Sault Ste. Marie Canals for the season to Aug. 1, short tons:

	1911	1912
Anthracite	938,432	505,225
Bituminous	5,899,591	5,981,229
Total	6,838,023	6,486,454

Foreign Markets.

Great Britain

Aug. 16—Admiralty list coals are very well stemmed over the remainder of the month and prices are firm with an upward tendency. Monmouthshire coals are also favorably situated. The docks are well filled with tonnage and there is every promise of the total exports for August proving of a record character. Prices are approximately as follows:

Best Welsh Steams	$4.20 @ 4.26
Seconds	3.96 @ 4.08
Thirds	3.78 @
Best Dry Coals	4.08 @ 4.20
Best Monmouthshires	3.84 @
Seconds	3.66 @
Best Cardiff Smalls	4.14 @
Seconds	2.59 @

The prices for Cardiff coals are f.o.b. Cardiff, Penarth, or Barry, while those for Monmouthshire descriptions are f.o.b. Newport, exclusive of wharfage, and for cash in 30 days—less 2½%.

British Exports—The following is a comparative statement of the British exports for July, 1911-12 and the first 7 months of the current year:

	July 1911	July 1912	7 Months
Anthracite	197,072	304,022	1,278,215
Steam	3,442,615	4,961,888	23,682,055
Gas	884,559	1,260,008	5,747,845
Household	115,898	161,813	802,268
Other sorts	239,414	354,135	1,704,806
Totals	4,879,558	7,041,866	33,215,189
Coke	82,651	85,978	474,086
Patent Fuel	129,227	191,945	827,228
Coal, Coke, & Pat. Fuel	5,091,436	7,319,789	34,515,503

Financial Notes

Colorado Fuel & Iron Co.—This company has only $2,000,000 preferred stock authorized and outstanding so that the 71% of unpaid back dividends all total only $1,420,000. Were it not for these unpaid dividends, the 1911-1912 showing on the common, after the 8% preferred, would be equal to 4.2%.

Reading Co.—This company will have between 10½% and 11% for the $70,000,000 common stock as result of operations for the fiscal year ended June 30. This estimate is based on eleven months operation and the equal of June 1911. The earnings compare with 12.1% in 1911, 12.7% in 1910, 11.4% in 1909, 11.2% in 1908 and 11.1% in 1907.

Lackawanna Coal & Lumber Co.—This company has a capital of $12,000,000 and an authorized bond issue of $15,000,000, 6%, 50-year bonds, The company owns in fee 53,000 acres of coal and timber land in West Virginia and has outstanding about $6,150,000, 6% bonds, in addition to $2,850,000 now being offered for sale to provide funds with which to improve the plant of the Paint Creek Collieries Co.

O'Gara Coal Co.—When the rates for employers liability insurance were increased from $1.15 per hundred of pay roll to $2.25 this company decided to carry its own insurance and established a sinking fund for that purpose equal to the first amount mentioned. In spite of some 550 accidents, 24 of which were fatal, it expects to have a surplus in this account, thus affecting a saving of from $20,000 to $25,000 per year.

Paint Creek Collieries Co.—The total authorized issue of this company amounts to $3,000,000, of which $2,900,000 are outstanding and $100,000 held in the treasury. There is deposited with the trustee for account of the sinking fund of its bonds $625,000 capital stock and $1,250,000 first mortgage, 5%, 50-year bonds of 1909 of the Crescent Coal & Lumber Co., or one-half of the entire issue of the company which owns in fee 17,000 acres of valuable coal and timber land located in Boone County, West Virginia.